Next Meeting, The American Association of Orthodontists, San Francisco, California, May 8 through 12, 1955. Headquarters, The Fairmont Hotel.

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AMERICAN JOURNAL OF ORTHODONTICS

OFFICIAL PUBLICATION OF
THE AMERICAN ASSOCIATION OF ORTHODONTISTS,
ITS COMPONENT SOCIETIES, AND
THE AMERICAN BOARD OF ORTHODONTICS

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Vol. 40, No. 11, November, 1954. American Journal of Orthodontics is published monthly by The C. V. Mosby Company, 3207 Washington Blvd., St. Louis 3, Mo. Subscription price: United States and its possessions, $10.00; Canada, $10.25; Foreign, $11.00. Entered as Second-class matter, January 14, 1915, at the Post Office at St. Louis, Missouri, under the Act of March 3, 1879. Printed in the U. S. A.

American Journal
of
ORTHODONTICS
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VOL. 40 NOVEMBER, 1954 No. 11

Original Articles

A POLYGON PORTRAYAL OF CORONAL AND BASAL ARCH DIMENSIONS IN THE HORIZONTAL PLANE

ASHLEY E. HOWES, D.D.S., NEW ROCHELLE, N. Y.

THE role of cephalometrics in the study of the lateral aspects of the face and denture has assumed a position of great importance in the diagnosis of malocclusion and is being rightly regarded by orthodontists with ever greater interest. The horizontal dimensions of the denture, which once were our principal concern, now seem to be receiving less attention. Possibly this is because it is felt that there is nothing further to be learned on the subject and we can therefore devote ourselves to a newer interest. It is with the hope of combining the more important horizontal dimensions with the cephalometric x-ray appraisal that this article is presented.

In 1951 Vorhies and Adams[1] presented a paper entitled "A Polygonic Interpretation of Cephalometric Findings." This was a graphic portrayal of the Downs[2] appraisal of normal facial and dental variations in profile.

There is no need to go into the details of this chart, as it has been described in the literature. I have found it most useful in my practice, and from it I got the idea of trying to show the normal variations in tooth material and in length and breadth of the denture in a similar manner. Wylie[3] modified the Vorhies-Adams graph (in order to simplify its use) so that the calibrations on the paper represented whole figures rather than values which ended with the same decimal as the various means figures. Advantage has been taken of this idea of Wylie's in the preparation of the denture measurement graphs.

By placing the Vorhies-Adams graphs side by side instead of one below the other, the cephalometric polygons and similar polygon representations of

Presented before the Northeastern Society of Orthodontists in New York City, March, 1954.

denture measurements have been combined on one sheet of paper (Fig. 1). Two additions have been made to the cephalometric analysis—the *AB* occlusal plane angle, which I believe to be significant, and the *SNA—SNB* difference, as described by Riedel.[4] The two lower graphs or polygons show minimum and maximum limits of the maxillary and mandibular arches of normal dentures. The measurements pertain to permanent dentitions only and were made on a comparatively small number of cases. It is hoped that someone, or some orthodontic department, with a large amount of material available will check and, if need be, alter the figures.

On the left of the two lower forms in Fig. 1 are the maxillary measurements and percentage computations, while those of the mandible are on the right.

There are four actual measurements in millimeters, both maxillary and mandibular, and three percentage computations made from the other four. The measurements can be taken directly from the models, which should record as much of the anatomy above and below the crowns of the teeth as possible. As can be seen from the chart, the seven recordings are of tooth material, first bicuspid coronal arch width, percentage of this width to tooth material, first bicuspid basal arch width, percentage of this width to tooth material, basal arch length, and percentage of this arch length to tooth material.

All these measurements or relationships will be taken up individually later.

Looking at the graphs as a whole, one is impressed with the narrowness of the lower polygons, after they have tapered down from tooth material variations. This indicates that, at least in the fifteen good occlusions used to compute this chart, there was a comparatively small range of variation in the remaining six values. When one plots a malocclusion with crowded teeth on this picture of normal variation, the line may start outside the left side of the graph outline (that is, with an excessive amount of tooth material) and then cross the normal pattern to be outside of it on the low side of several of the following figures. In almost all good occlusions measured, cases with tooth material on the high side of the mean did not cross the mean line. Some of the cases with tooth material less than the mean did cross the mean line to the higher side. No cases followed the mean line exactly. Believing that 0.1 or 0.2 mm. or tenths of 1 per cent can be disregarded in these graphs, we have altered some of the maximum and minimum figures to the nearest half millimeter or half of 1 per cent.

Going into more detail on the various denture measurements, the first figures are of maxillary and mandibular tooth material. This represents the sum of the mesiodistal diameters of twelve teeth—the incisors, cuspids, bicuspids, and first molars. In the normal samples available, this measurement in the maxillary arch ranged from a maximum of 98 mm. to a minimum of 85.0, with a mean average of 91.7. In the mandibular arch the range was 89 mm., maximum, and 78.5 mm., minimum, with a mean average of 84.1 mm. Excellent occlusions must exist with a larger amount of tooth material than the maximum here listed, but it is believed they would be quite exceptional. Many malocclusions presented for orthodontic treatment have a greater

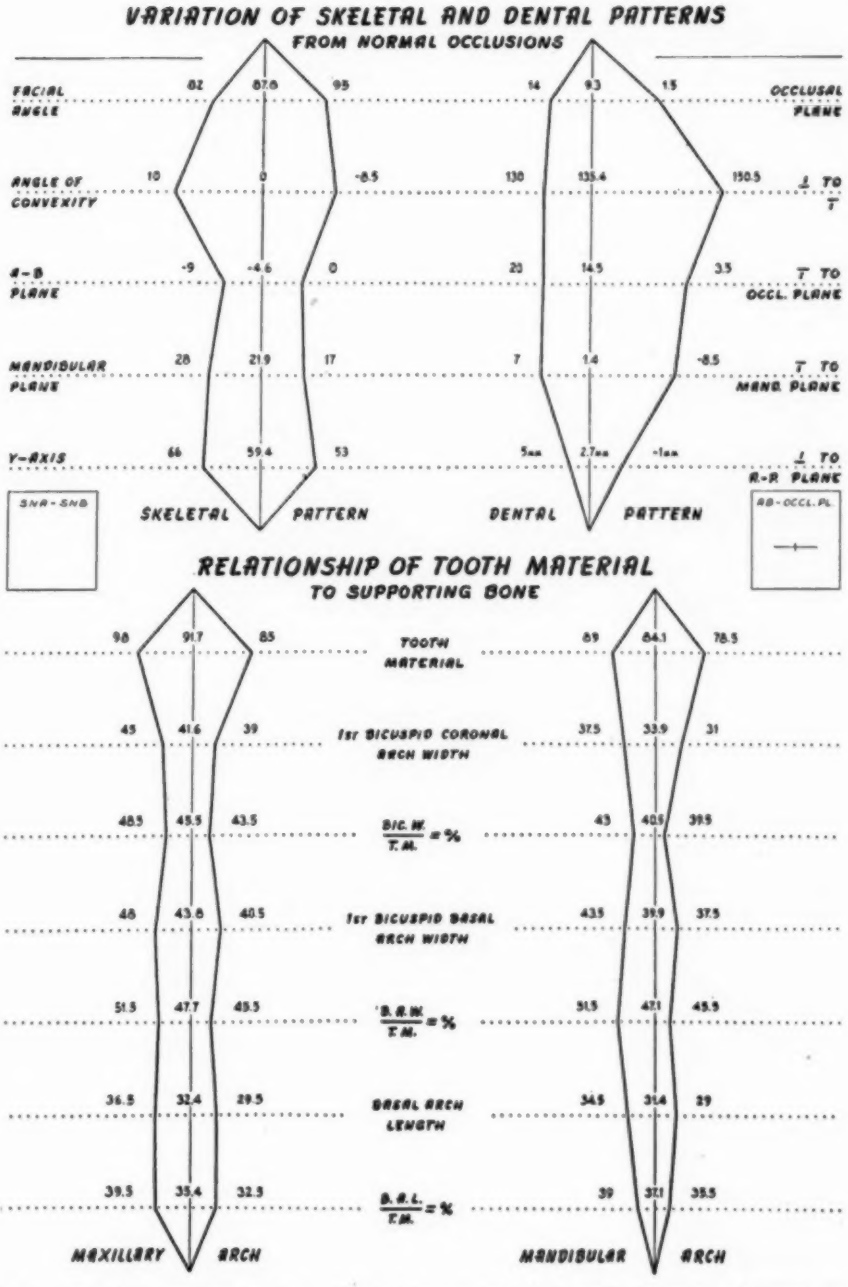

Fig. 1.—The two outline forms at the top are Vorhies and Adams' polygonic portrayal of Downs' appraisal of normal facial and dental variations in profile.

The two lower forms represent various minimum and maximum limits of maxillary and mandibular arches of normal dentures, and the relationship of these measurements to tooth material.

amount of tooth material than the maximum listed. We have recorded as much as 114 mm. of maxillary first molar-to-first molar tooth material, and 104 mm. in the mandibular arch. In a very few instances, good results without extractions have been obtained in the treatment of malocclusions with oversized teeth, but in those cases there was a correspondingly large amount of basal arch width and length. It can be assumed that if stable results have been obtained in such treated cases, then similar untreated occlusions—that is, with more than 100 mm. of maxillary tooth material—could be found if enough people were examined. However, it was decided that the inclusion of such cases, which occurred so infrequently (at least in our practice), would not add to the practical value of the graphs. In other words, 100 mm., or more, of maxillary tooth material with irregular alignment of teeth is common; 100 mm., or more, of tooth material with regular alignment of teeth, either naturally or orthodontically acquired, is rare. The amount of tooth material can be reduced by extraction so that it will be more in harmony with other measurements which are to be explained later. However, if four bicuspids are extracted, the tooth material is reduced 12 to 16 mm. in each arch. This reduction may place the tooth material outside the graph on the opposite side.

Turning now to the minimum amount of tooth material, my figures for this may be quite inaccurate, as I do not see as many people with small teeth as I see with large teeth. Not as many of them come to the orthodontist. Some patients with small teeth have large basal arches, and they are brought to have spaces between the teeth closed. If there is considerable disparity between tooth material and basal arch dimensions, it may be necessary to increase the amount of tooth material by prosthetics. The relationship of tooth material to basal arch dimensions should be borne in mind in deciding whether to close or open spaces when the lateral incisors are congenitally missing.

The mandibular, rather than the maxillary, tooth material seems to have attracted the attention of the orthodontist because of his interest in mandibular incisor irregularity and axial angulation. Focusing attention on the mandibular incisor area has made the orthodontist more aware of tooth size, and also has forced him to recognize the danger of improperly applied intermaxillary force.

However, stressing the importance of a significant area, such as the mandibular incisor area or the canine fossa area, was never intended to minimize the necessity of considering the problem of diagnosis of malocclusion as a whole. Part of this problem is the interrelation of maxillary and mandibular tooth material. When the amount of tooth material has been entered on the graph, it can be seen immediately how it compares with the so-called normal range, and also whether or not the maxillary and mandibular tooth material is harmonious. In good occlusions this relationship varies slightly, depending on whether the teeth are large or small. In the chart of normal dentitions the minimum mandibular figure is a little more than 92 per cent of the minimum maxillary figure, the mean is about 92 per cent, and the

maximum mandibular figure is about 91 per cent of the maximum maxillary figure. In other words, as the tooth material increases, the proportion of mandibular tooth material to maxillary tooth material decreases. It is not necessary to compute this percentage for each case, as the disparity can be observed in the graph. In most such disparities, the mandibular teeth are too large for the maxillary teeth, but it can be the other way, particularly when the maxillary central or lateral incisors are wider than they should be. Before leaving the subject of tooth material, I should like to stress the point that, of all the factors with which we have to deal in our consideration of malocclusion, tooth material is the only one that is completely controlled by heredity. It cannot be influenced by environmental forces, and it can be altered only by extraction or stripping of contact points.

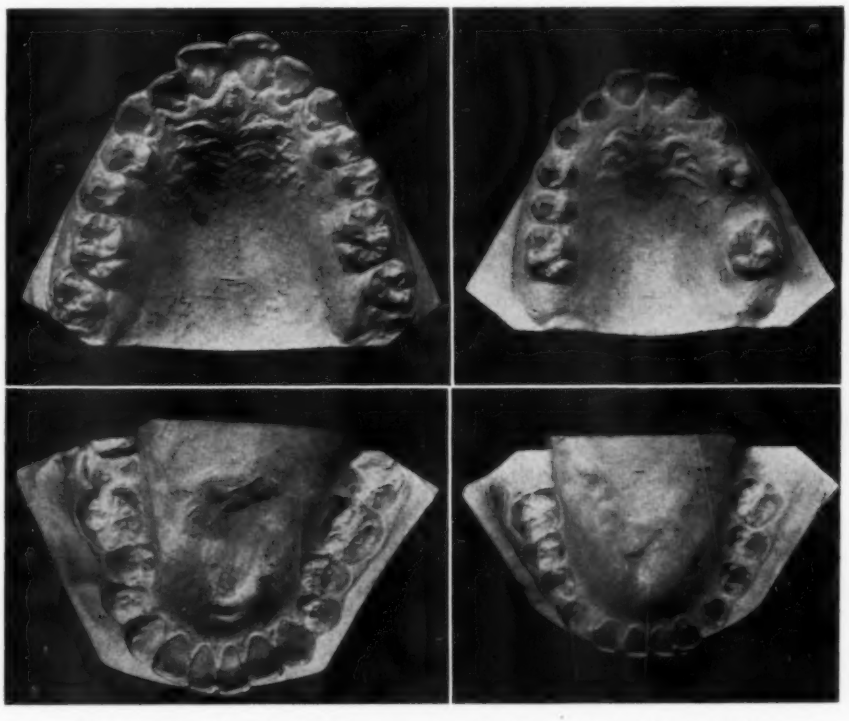

Fig. 2.—Small and large amounts of tooth material contrasted.

Fig. 2 illustrates the contrast between a large and a small amount of tooth material.

The second measurement on the graph is first bicuspid coronal arch width. This measurement is the distance between the summits of the buccal cusps of the first bicuspids. From the graph, it can be seen that the good occlusions measured from 45 mm. to 39 mm. in the maxillary arch, with a mean of 41.3 mm., and from 37.5 mm. to 31 mm. in the mandibular arch, with a mean of 33.9 mm. The bicuspid coronal and basal arch area, which was previously the deciduous molar area, is a most important region in the consideration of malocclusion. Bicuspid width is controlled by heredity and the muscular forces

that surround the denture. Tongue action and tongue position play an extremely important role in the establishment of arch form, or the maintenance of it after orthodontic modification. While it would be inaccurate to say that malocclusion is a problem of the bicuspid area, I do not think it would be generalizing too much to say that crowding of the teeth is a problem of the bicuspid area. This area, being forward of the malar bones, is the beginning of the snout, and therefore can be molded by the action of the surrounding muscles. Recognizing that the balance of muscular forces greatly influences arch form, some investigators have decided that the only way to avoid relapse after treatment is to maintain the status quo and reduce the amount of tooth material so that it can be fitted into the existing coronal arch form. This eliminates expansion as a treatment procedure. In spite of my relapses, which have been numerous, I still am not in agreement with this assumption, and still believe that, with sufficient basal arch support, some coronal arches can be expanded, and a rebalance of muscular forces will take place which will maintain the new arch form.

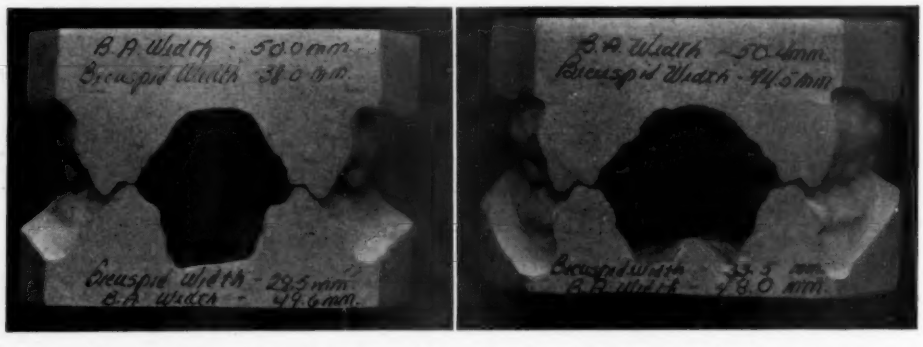
B.A. Width - 50.0 mm.
Bicuspid Width - 38.0 mm.
Bicuspid Width - 28.5 mm.
B.A. Width - 49.6 mm.
B.A. Width - 50.4 mm.
Bicuspid Width - 44.5 mm.
Bicuspid Width - 33.5 mm.
B.A. Width - 48.0 mm.

Fig. 3.—Coronal arches expanded. Basal arches remained the same.

The uncertain factor in this treatment is whether or not the rebalance of muscular forces will be achieved. Experience will help in deciding in advance of treatment whether it will or will not. It is taken for granted that, in the treatment of any so-called Class II case, either Division 1 or Division 2, a rebalance of muscular forces will be achieved. Otherwise, our treatment would be ineffective. A rebalance of the muscular forces also can occur following expansion if the basal arch width is sufficient. But sufficient basal arch width, while essential, is not the governing factor. Muscular influences, particularly the position of the tongue in action and at rest, are the important factors in the maintenance of coronal arch form.

Fig. 3 illustrates a case in which considerable coronal arch expansion has been achieved. The basal arch width is unchanged. I believe that such expansion calls for a long period of retention, maintaining arch form while additional vertical and anteroposterior facial growth takes place. After the eruption of the bicuspids, growth will rarely, if ever, increase the lateral dimensions of the arches, but will increase, in varying amounts, the height and

depth of the face. It is my dogmatic opinion that this additional growth is an important factor in the final balance of muscular forces which will govern denture form.

The results of the use of extraoral force has made me more convinced than ever that, with sufficient basal arch width, coronal expansion can be achieved and maintained, because in some of the cases treated with extraoral force, expansion takes place naturally. This natural expansion probably is due to a change in tongue position and a new balance of muscular forces. It might be assumed that, through the backward force being applied, the teeth have moved distally into a wider part of the arch, and so the lateral measurement between the bicuspids is increased. Both surveys and cephalometric measurements can be used to investigate this possibility.

Fig. 4 illustrates a labial arch with a labial face-bow, similar to that described by Kloehn, but with a cervical elastic strap instead of a headcap, and the addition of an anterior elastic to press against the front teeth. The force of the cervical strap is exerted against the molars, as the stops on the arch rest against the buccal tubes and hold the arch away from the anterior teeth. The small elastic on the anterior hooks exerts a much smaller amount of inward force on the anterior teeth than the force of the cervical strap exerts against the molars.

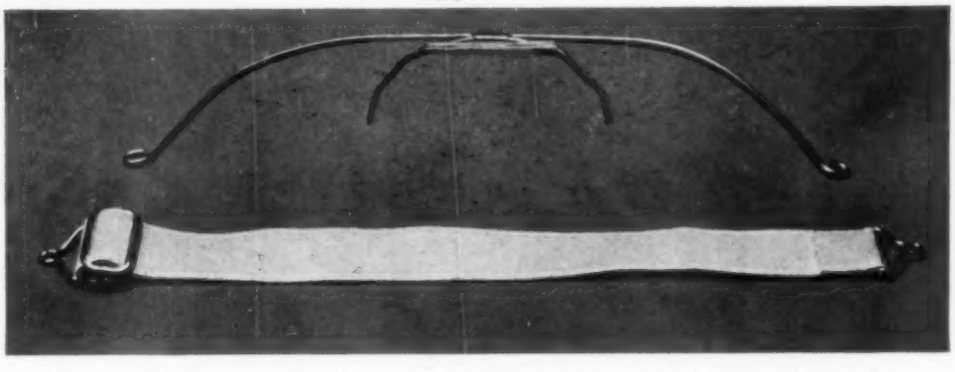

Fig. 4.—Labial bow and anterior elastic with cervical strap for extraoral force.

Fig. 5 shows a case treated with this appliance, and it can be observed that not only have the maxillary and mandibular teeth been moved inward, but the arch form has changed. Both maxillary and mandibular coronal arches are shorter and wider. Bearing in mind that there was never any appliance on the mandibular arch, and only a part-time labial appliance on the maxillary arch, it appears that the arches must have widened in response to a rebalance of muscular forces, and there seems to be no reason why the new arch width will not be maintained, unless the child returns to her original abnormal tongue position and bad lip function.

The third figure on the graph is the percentage relationship of first bicuspid width to tooth material. It is naturally of greater importance than the actual bicuspid width measurement, as it relates arch width to the size

of the teeth. It is obtained by dividing bicuspid arch width by tooth material. The range is 48.5 per cent, maximum, 43.5 per cent, minimum, and 45.1 per cent, mean, for the maxillary arch; and 43 per cent maximum, 39.5 per cent, minimum, and 40.5 per cent, mean, for the mandibular arch. It is quite essential that cases treated with a full complement of teeth should fall within this range if we are to approximate a normal occlusion. This is true also of the two other percentage relationships which follow.

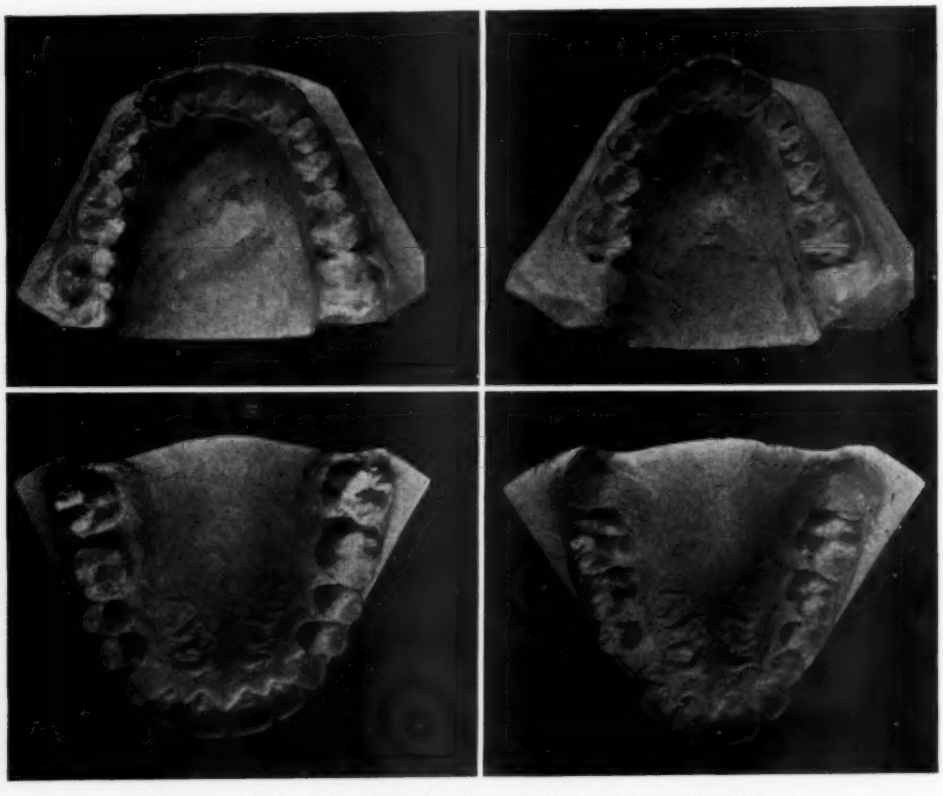

Fig. 5.—Case 1946 treated with appliance shown in Fig. 4.

The fourth item on the graph is the basal arch width above the maxillary first bicuspids and below the mandibular first bicuspids. Notice that in these measurements, taken from normal occlusions, the basal arch measurements exceed the coronal arch measurements, two lines above. The basal arch is wider than the coronal arch. This is extremely important. In stressing the importance of this area in a previous paper,[5] I may have created the impression that the width of the mandibular basal arch is disregarded. This, of course, is not true. All surveys were always of both maxillary and mandibular models. In the normal cases the maxillary and mandibular basal arch outlines generally coincided, at least as far back as the first molars, but when the maxillary basal arch is narrow in the canine fossa region, the mandibular basal arch is generally narrow also. When the maxillary coronal and basal arches have sufficient width, and the mandibular arch is narrow, the mandibular

buccal teeth would naturally be in linguoversion and, in such a case, if treatment is started early, it appears possible to expand both the coronal and basal mandibular arches. An example of this has been shown in a previous article.[6] Whether or not the maxillary basal arch can be expanded after the eruption of the permanent side teeth still remains a subject of discussion. I have seen no evidence that it can. I have seen cases in which the basal arch measurement opposite the first bicuspids was larger after treatment than before treatment, but they were cases in which the bicuspids were moved back into a wider part of the arch. In some cases, it takes only 2 mm. of distal movement to gain 3 mm. of basal arch width.

The fifth item on the graph is the percentage relationship of first bicuspid basal arch width to tooth material. This is computed by dividing basal arch width by tooth material. In the maxilla this is 51.5 per cent, maximum, and 45.5 per cent, minimum, with a mean of 47.7 per cent. In the mandible, it is 51.5 per cent, maximum, and 45.5 per cent, minimum, with a mean of 47.1 per cent. Notice the similarity of maxillary and mandibular figures. This percentage relationship is more important than the actual measurement of basal arch width. There is a wide range of variation in these figures in malocclusion. Many malocclusions with crowded teeth are less than the normal minimum. When this occurs, it is likely to be an extraction case, but first it must be decided whether the basal arch is actually narrow or whether the bicuspids have moved forward into a narrower part of the arch. Axial inclination of the bicuspids and basal arch length, which is to be described next, are the important factors in making the decision. Distal movement will be discussed further under basal arch length. One cannot say that extraction is indicated at exactly a certain percentage relationship. Unless the side teeth can be moved distally, anything under 45 per cent will result in some crowding, if treated with a full complement of teeth; but, if other factors are favorable, acceptable results often can be achieved with percentages slightly lower than 45 per cent. Cases with a percentage relationship of 40 or less will generally require extraction. Skeletal pattern, dental pattern, denture dimensions, and muscular balance must all be considered when deciding what the treatment plan is to be. A steeper than normal mandibular plane accompanied by deficient basal arch width makes the prognosis doubly poor, and extractions are generally indicated. When these two conditions are combined with a high difference between *SNA* and *SNB*, extraction may complicate, rather than improve, a very bad situation and no treatment at all may be indicated.

Arch width in the molar region has not been included in the graphs, but it should not be assumed that it is disregarded. We believe that if there is sufficient basal arch width in the bicuspid region, permitting coronal arch expansion in that region, the arch can also be expanded in the molar region if proper arch form requires it. In the maxillary arch, first molar width should be 57.5 per cent of maxillary tooth material, plus or minus 1 per cent. The measure-

ment is made from the buccal groove on the marginal ridge to the same point on the opposite side.

The sixth item on the graph is basal arch length, which is the midline length of the basal arch from the distal of the first molars to the most anterior point of the basal arch. This is the Downs A point in the maxilla, and B point in the mandible. We first tried measuring arch length on the profile x-ray tracing, but found it varied from the actual measurements of the model and so could not be combined with other model measurements. In recording this measurement, a wire is placed across the distal surfaces of the first molars. Then, with the models planed with their bases parallel to the occlusal plane, the center of this wire is projected vertically to the midline of the palate on the maxillary model, and to a midline point on the mandibular model which is approximately on the same plane as the B point. The distance from this midline point to the most anterior point of the basal arch is measured with a Boley gauge.

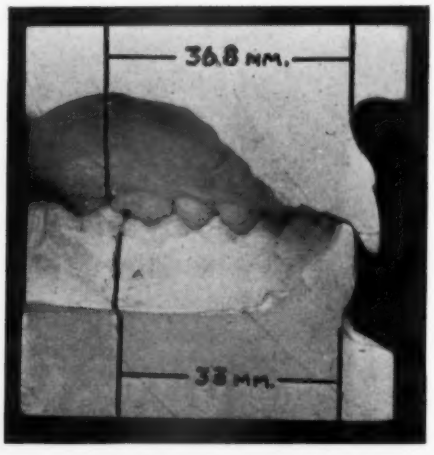

Fig. 6.—Basal arch length to distal of first molars.

In Fig. 6 the models have been cut through the midline to show what the measurement represents. Arch length measurements, made with calipers on the models, have been checked many times with measurements made on a surveying machine and have been found to be quite accurate. Of course, if a first molar has migrated forward on one side, the arch length will be shortened by one-half the distance of the forward movement. If there has been much unilateral forward movement of the buccal teeth, arch length for each side should be recorded.

In the maxillary arch, the maximum length of the good occlusions was 36.5 mm., and the minimum 29.5 mm., with a mean of 32.4 mm. In the mandibular arch, the maximum was 34.5 mm., the minimum 29 mm., and the mean 31.5 mm. These figures have been somewhat confusing, as we have found a number of malocclusions with arches longer than the maximum normal measurements. Most mixed dentition cases exceed the maximum, but it has been well established that both the maxillary and mandibular arches shorten when the deciduous molars are replaced by the bicuspids. Another observation, based on the mal-

occlusions charted, is that foreshortened arches, except in cases of premature loss of deciduous second molars, are not as common as we thought they were. This is particularly true of the maxillary arch. Often in cases with blocked-out cuspids, with the buccal segments apparently forward of where they should be, the arch lengths will be normal and the big discrepancy will be in the narrowness of the coronal and basal bicuspid area. Maxillary arch length can be increased by moving the molars distally, but if this is done with intermaxillary force the mandibular arch length is likely to be decreased. Extraoral force seems to be a better method of accomplishing distal movement, but, even when extraoral force is used, a comparison of the before- and after-treatment profile tracings show much less distal movement than we thought we had obtained. In the mandibular arch, even after employing extraoral force, we have rarely been able to demonstrate an increase in arch length, unless there have been extractions distal to the first molars.

The final value of the graph is the percentage of arch length to tooth material. As in the case of arch width, the percentage relationship is more important than the actual measurement. It is obtained by dividing arch length by tooth material. It can be increased somewhat in the maxilla, but very little, if any, in the mandible. Therefore, when it is deficient in the mandible, it becomes impossible to obtain a satisfactory stable result if a full complement of teeth is maintained, and so extraction of dental units should be considered.

Models, profile tracings, and graph recordings of three cases follow:

Fig. 7 shows the models and photographs of a boy with nearly normal occlusion. Arch width is good, but the anterior teeth are slightly protrusive, and the mesiodistal relations on the right side are not quite right. The profile

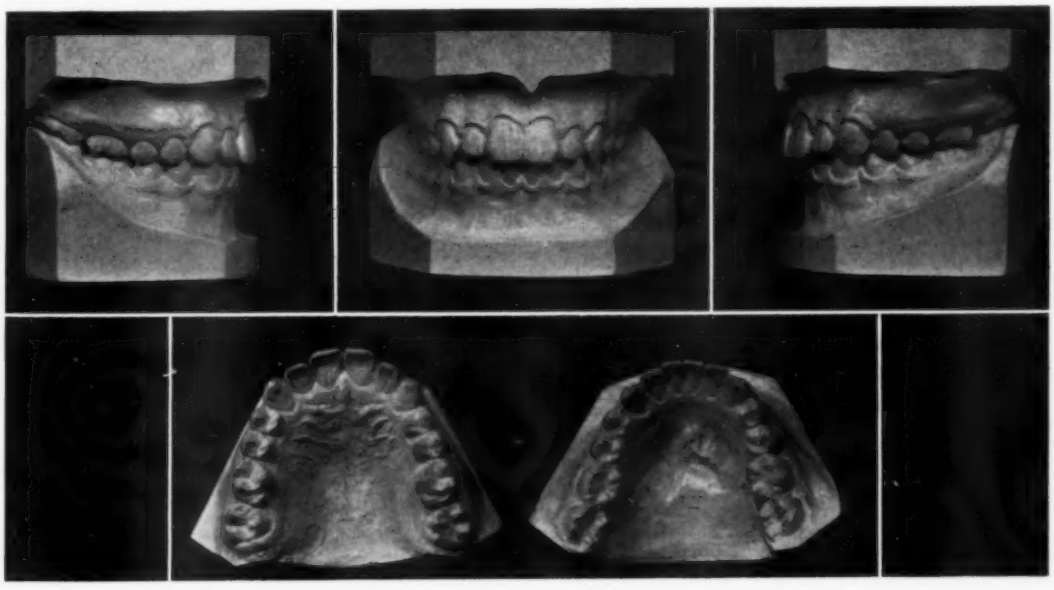

Fig. 7*A*.—Models of untreated patient, with good occlusion and good facial pattern as shown in Figs. 8 and 9.

roentgenogram (Fig. 8) shows an excellent skeletal pattern with a slight protrusion of the anterior teeth.

The graphs (Fig. 9) show this very clearly. He is well within the skeletal pattern figure, but his maxillary-to-mandibular incisor angle falls outside the dental pattern. The incisal edge of his maxillary incisor is also 2 mm. outside

Fig. 7*B*.—Photographs of untreated patient with good occlusion and good facial pattern.

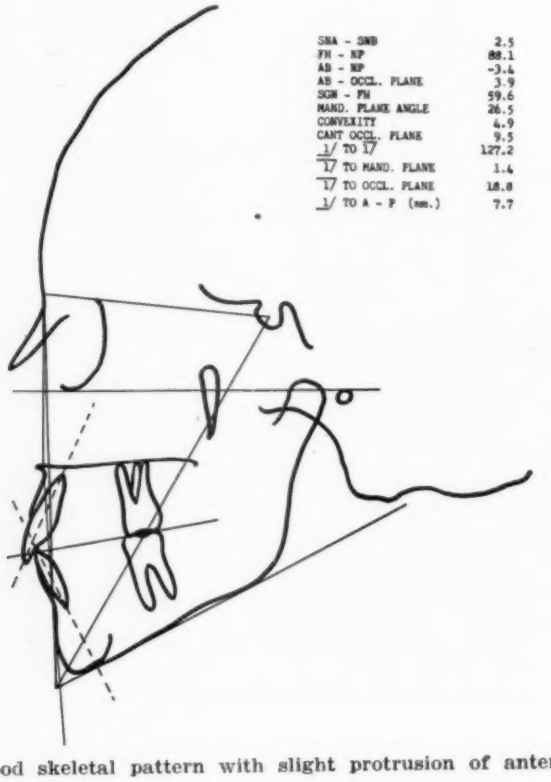
SNA - SNB 2.5
FH - NP 88.1
AB - NP -3.4
AB - OCCL. PLANE 3.9
SGN - FH 59.6
MAND. PLANE ANGLE 26.5
CONVEXITY 4.9
CANT OCCL. PLANE 9.5
1/ TO 1/ 127.2
1/ TO MAND. PLANE 1.4
1/ TO OCCL. PLANE 18.8
1/ TO A - P (mm.) 7.7

Fig. 8.—Good skeletal pattern with slight protrusion of anterior teeth.

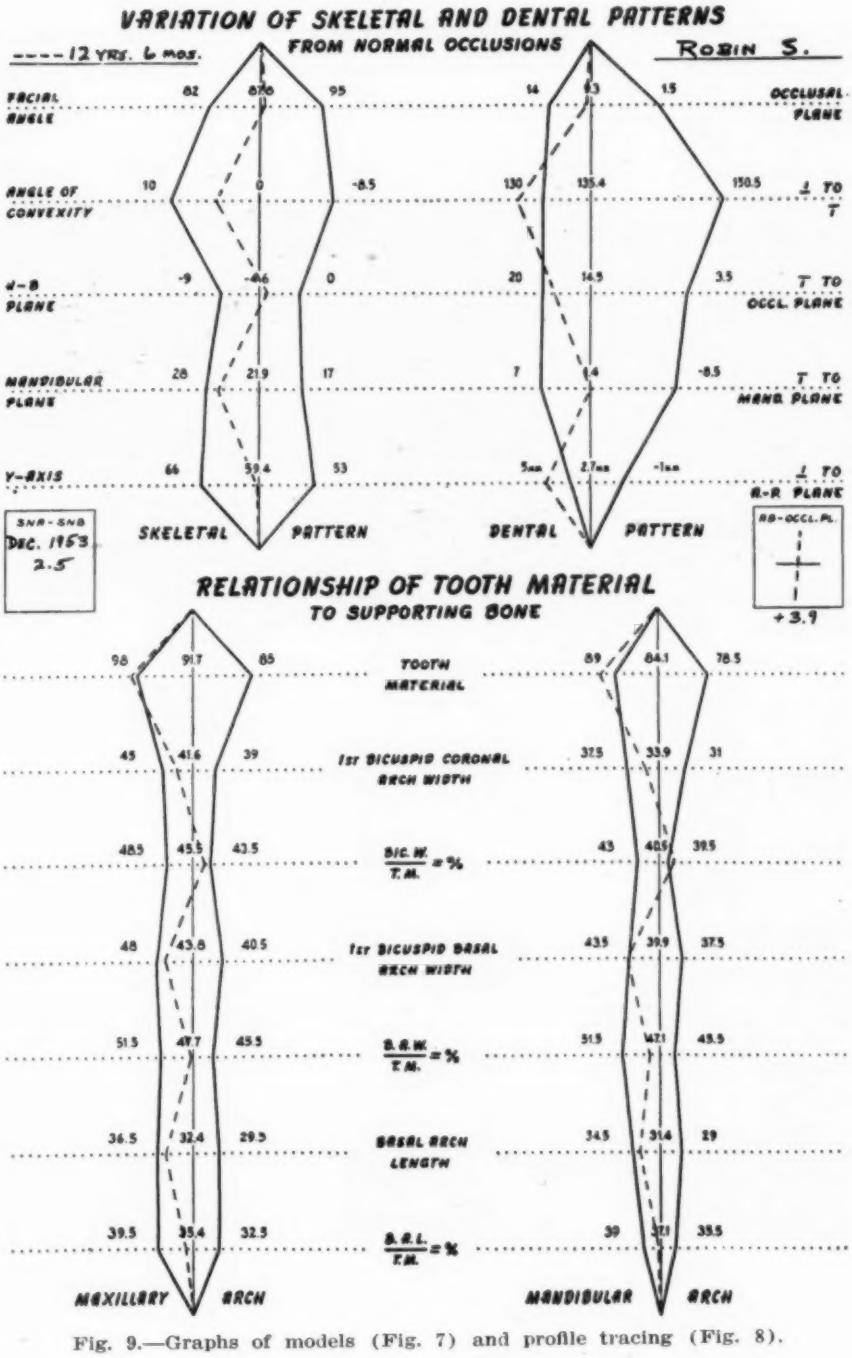

Fig. 9.—Graphs of models (Fig. 7) and profile tracing (Fig. 8).

the normal range. In the tooth material graphs, his maxillary tooth material is approximately at the top limit, while the mandibular tooth material is 2 mm. greater than the maximum limit. Thus, his mandibular tooth material is slightly too large for his maxillary tooth material, which would account for the slight mesiodistal malrelationship of the teeth on the right side. All his other figures fall within the normal pattern, and present a picture of a very satisfactory occlusion.

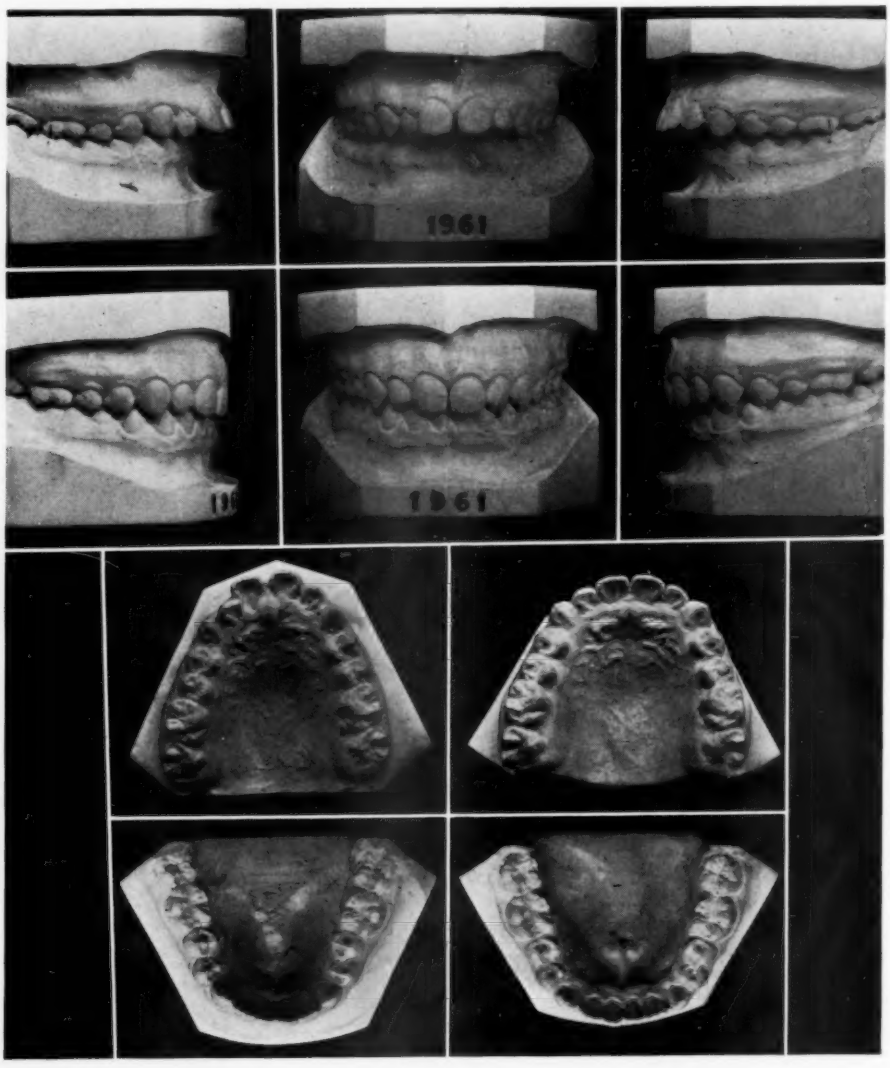

Fig. 10.—So-called Class II, Division 1 case. Graphs (Fig. 11) show normal skeletal pattern and denture dimensions.

Case 1961.—Fig. 10 illustrates a treated case which, judging from the models only, probably would be called a Class II, Division 1 case. Assuming that it can be classified as a satisfactory result, the graphs (Fig. 11) of the case indicate why.

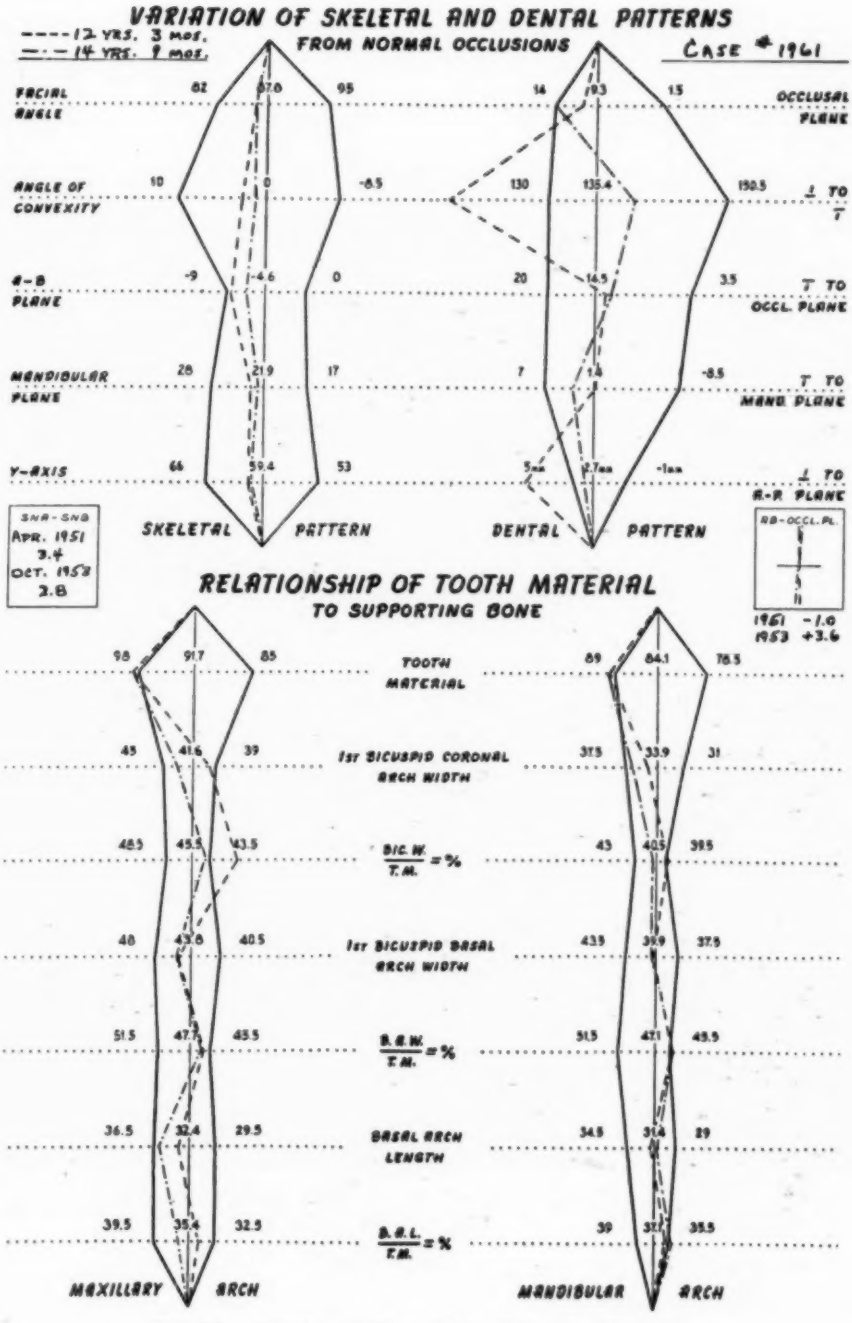

Fig. 11.—Graphs of Case 1961, shown in Fig. 10.

The skeletal pattern (Fig. 11) was good before treatment was started and was improved slightly by further growth, as the angle of the *AB* plane was reduced. This also appears in the reduction of the difference between *SNA* and *SNB,* although this angle was not excessive to begin with. The *AB*-to-occlusal plane angle improved, due to the beneficial facial growth and also the tipping of the occlusal plane by treatment.

Fig. 12.—Soft tissue changes in Case 1961 (Fig. 10).

In the graphs of the relationship of tooth material to arch form and supporting bone, everything fell almost within normal limits both before and after treatment. The bicuspid width was increased in both arches by treatment, maxillary arch length was increased, and mandibular arch length was decreased slightly. There probably will be some eventual crowding of the mandibular anterior teeth because of the slight deficiency in the mandibular basal arch width

and length. There was every reason to expect a good result and, if a rebalance of muscular forces has been achieved, the result should be stable. The photographs (Fig. 12) would indicate that this has been accomplished.

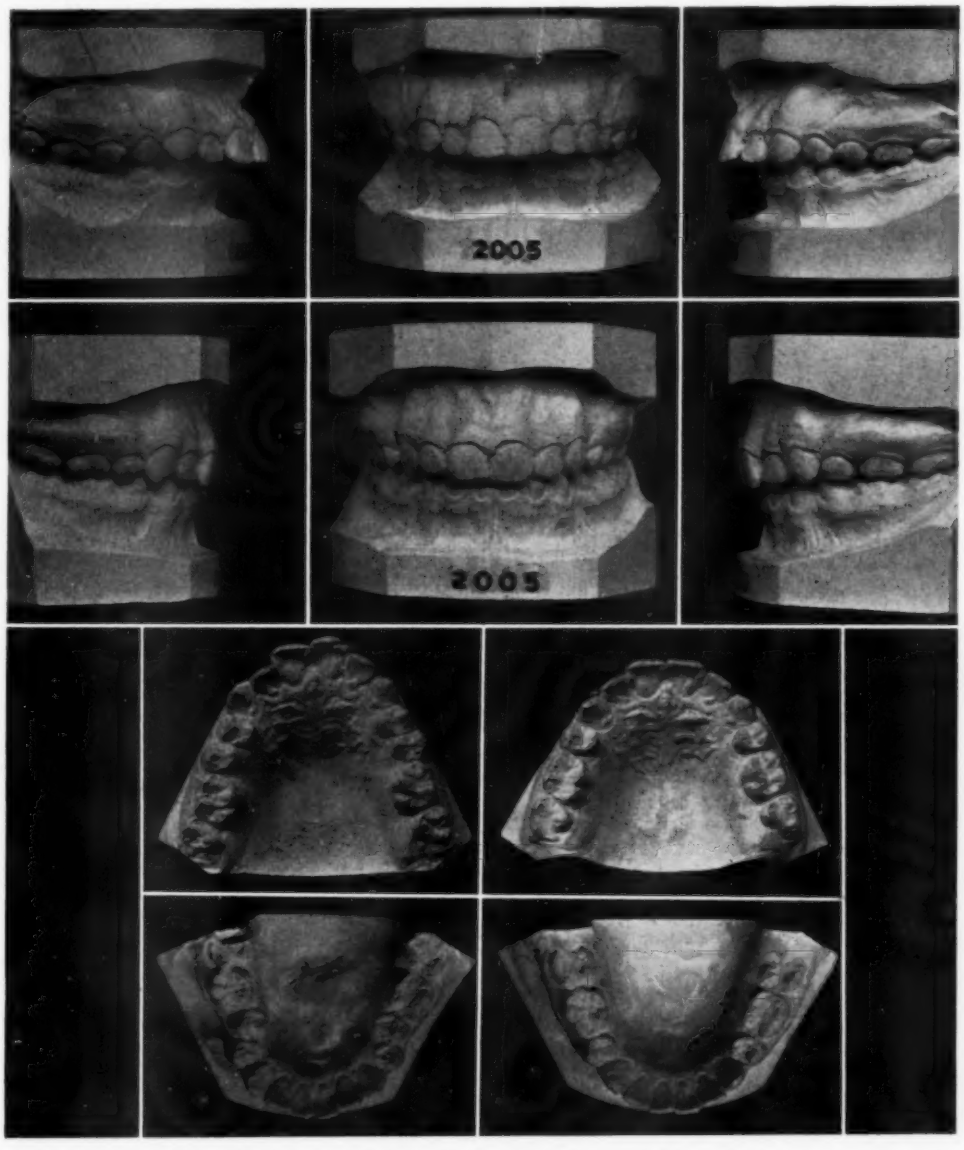

Fig. 13.—Extraction case, with exceptionally large teeth.

Case 2005 (Fig. 13).—We would need no graphs or records of any kind, if the patient could be seen, to brand this as an extraction case, but the graphs indicate why. Note the gigantic teeth and the distoclusion in the original condition. Four first bicuspids were extracted. The profile tracings (Fig. 14) show the excessive protrusion of the anterior teeth in the original condition and the amount of retraction accomplished.

In the graphs of the case (Fig. 15) the skeletal profile skirts the limits of normal, which tends toward Class II, but in the dental pattern the protrusion and labial inclination of both maxillary and mandibular incisors are extreme. This is because of the size of the teeth, shown in the lower graphs. There is 112 mm. of maxillary tooth material and 101.4 mm. of mandibular tooth material. The mandibular teeth of this case exceed the normal maximum figure for maxillary teeth. The actual measurements of bicuspid width, basal arch width, and arch length are all large, but the percentage relationships of these measurements to his great amount of tooth material are all small. If a

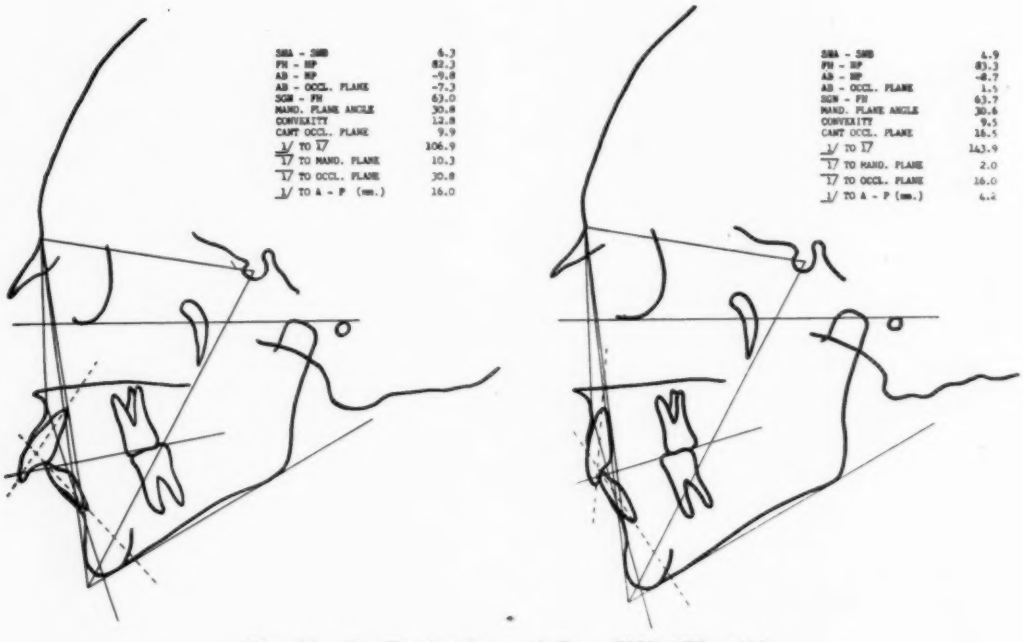
SNA - SNB 4.3
FH - NP 82.3
AB - NP -5.8
AB - OCCL. PLANE -7.3
SGN - FH 63.0
MAND. PLANE ANGLE 30.8
CONVEXITY 12.8
CANT OCCL. PLANE 9.9
⌊/ TO ⌈7 106.9
⌈7 TO MAND. PLANE 10.3
⌈7 TO OCCL. PLANE 30.8
⌊/ TO A - P (mm.) 16.0
SNA - SNB 4.9
FH - NP 83.3
AB - NP -8.7
AB - OCCL. PLANE 1.5
SGN - FH 63.7
MAND. PLANE ANGLE 30.6
CONVEXITY 9.5
CANT OCCL. PLANE 16.5
⌊/ TO ⌈7 143.9
⌈7 TO MAND. PLANE 2.0
⌈7 TO OCCL. PLANE 16.0
⌊/ TO A - P (mm.) 4.2

Fig. 14.—Profile tracings of Case 2005 (Fig. 13).

patient has an excessive amount of tooth material, arch width and length should be excessive also, if we plan to treat without extraction. The extraction of four bicuspids reduced both maxillary and mandibular tooth material 16 mm. His skeletal pattern was slightly improved after treatment, but there was a big change in his dental pattern. The occlusal plane tipped up, which improved the *AB*-occlusal plane relation. The maxillary to mandibular incisor angle was reduced 42 per cent. Part of this change was due to uprighting the mandibular incisors, and part of it was due to the retraction of the maxillary incisors, the incisal edges moving in 15 mm., or about three-fifths of an inch. In the tooth material graphs, the plotted lines straightened out and more or less followed the normal, with the exception of mandibular arch width, which is high for the reduced amount of tooth material. The photographs (Fig. 16) show the facial change.

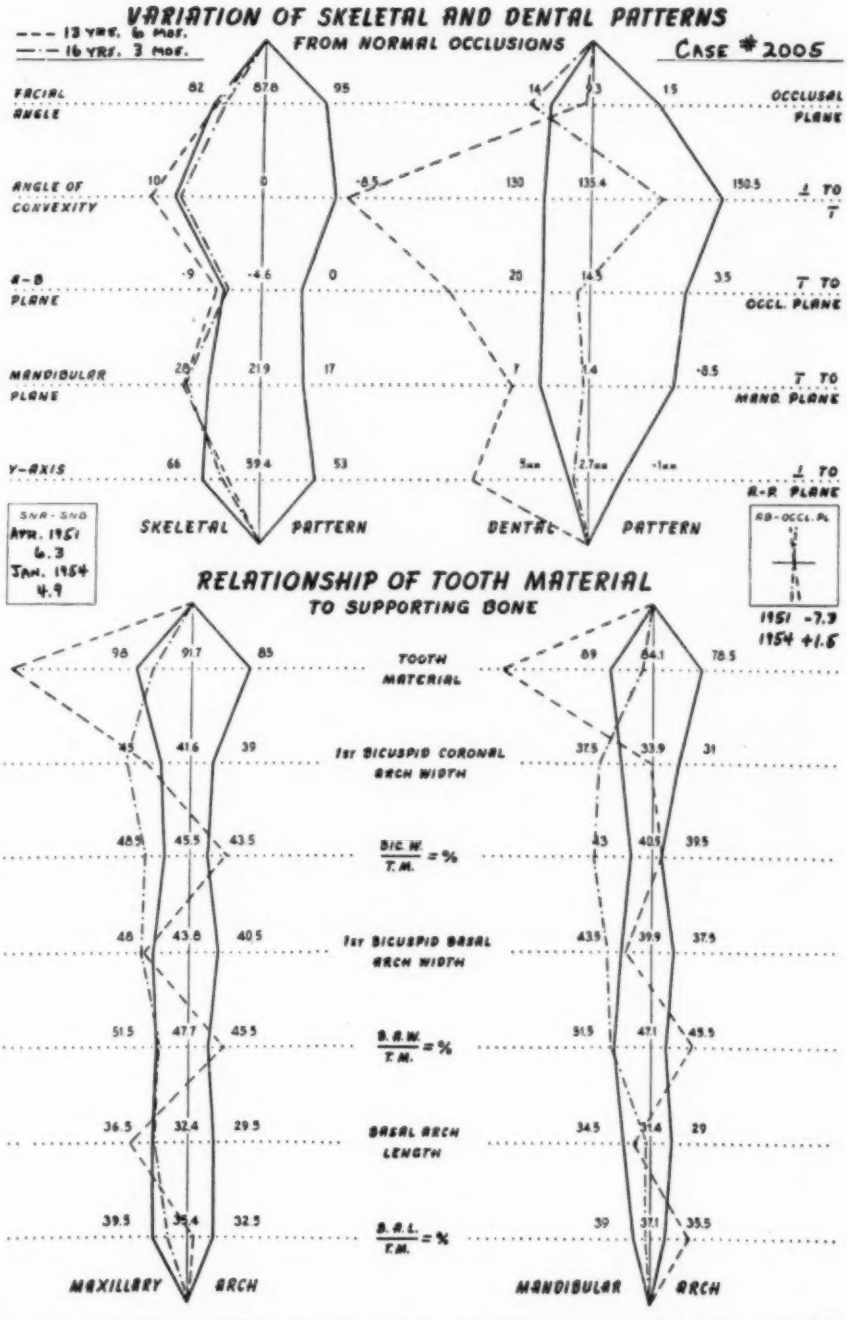

Fig. 15.—Graphs of Case 2005, showing large amount of tooth material and inadequate percentage relationships in arch width and length.

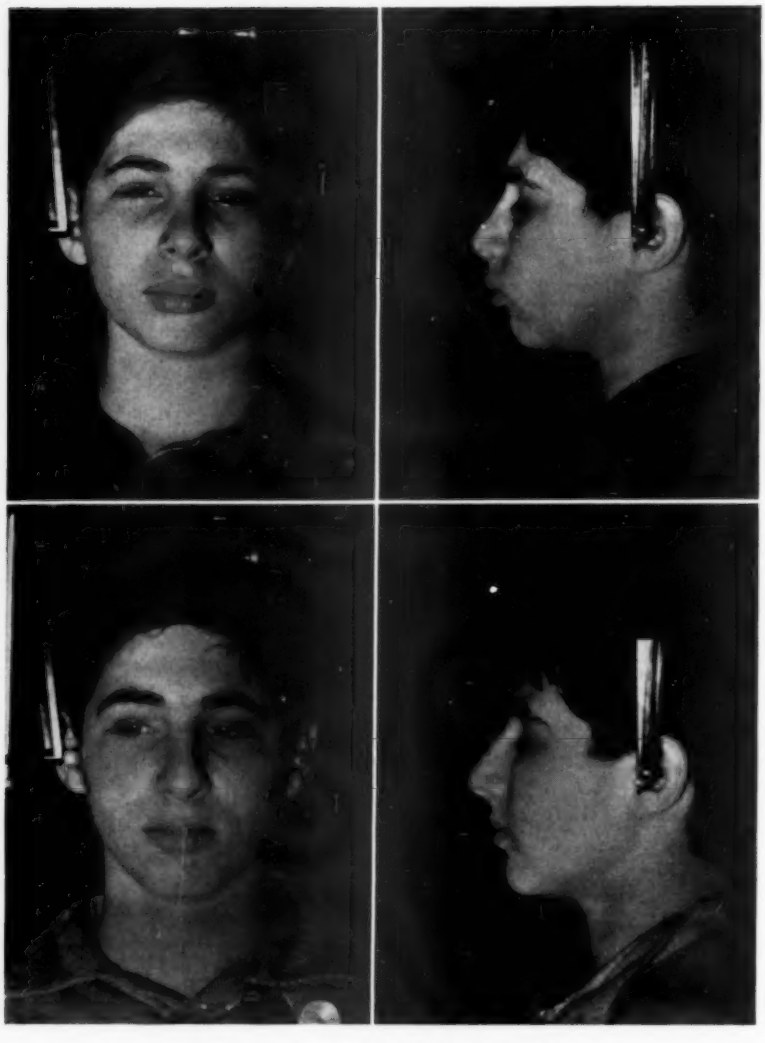

Fig. 16.—Photographs of Case 2005.

SUMMARY

In normal dentures there is a range of variation of tooth material, coronal and basal arch width, and basal arch length. There is a range of variation of the interrelationships of these various measurements, which can be plotted on graph paper so that a polygon form represents the normal limits. When similar measurements of malocclusion are plotted on these forms, the deviations from the normal can be observed. These charts or graphs of denture dimensions can be used in conjunction with similar graphs, which compare the cephalometric profile tracing with normal variations of it. Such graphs can be used to eliminate ambiguity in describing an individual dentofacial complex, and to demonstrate what has been accomplished by treatment. Finally, in an individual case analysis, the information obtained from the graphs, combined with other information, aids in planning treatment.

I wish to express my gratitude to my co-worker and associate, Dr. Norman D. Allen, for his work in assembling statistics and making the layout for this chart.

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650 MAIN ST.

PRINCIPLES AND METHODS OF TREATMENT

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TREATMENT of dentofacial deformities should be based on attainable results, as determined by clinical experience and research findings. Frequently, desirable clinical results are obtained and the changes made to produce them are correctly analyzed. In other instances, determination of what has happened is difficult, and interpretation is faulty. From experience and research, certain principles, laws, and theories have evolved that constitute a basis for treatment. Some of these may be listed under the following headings and subheadings.

I. *Why Teeth Move.*

1. Teeth move as a result of cellular response to stimulation.
2. Light forces elicit the best cellular response.
3. This stimulation can be either continuous or intermittent.

II. How Teeth Move; Response to Stimulation, Anchorage, or Resistance.

1. Teeth may be moved in any direction, especially if the anchorage or resistance from which the force is derived is adequate.
2. The easiest tooth movement is tipping, with the crown and root moving in opposite directions, the rotation being around a transverse axis at various distances from the root apex.
3. Bodily movement of teeth is the most difficult.
4. Teeth do not offer mechanical resistance to movement.
5. Bodily resistance in one segment of an arch cannot be combined with tipping resistance in other areas without reducing the speed of the tipping movement decidedly, as, for example, combining bodily resistance in a lingual direction in the incisor segment with resistance to distal tipping in the lateral segments of the dental arch.
6. Intraoral anchorage is not absolute, as the name implies, but is often adequate and can be enhanced in various ways.
7. Application of a distal force to the maxillary denture results, in some instances, in distal movement of these teeth, while in other instances, during growth, it may prevent any further forward migration of the denture and possibly of the body of the maxilla.

III. Bone Response to Stimulation.

1. A bone cannot be stimulated by pressure or tension to grow beyond its inherited potential.

Presented before the Northeastern Society of Orthodontists in New York City, March 9, 1954.

2. Bone growth may be inhibited or misdirected by pressure or tension.
3. Early treatment may remove inhibiting or misdirecting forces that are pressure or tension in nature.

IV. Importance of Musculature.

1. Muscles have much to do with the position and arrangement of the teeth relative to their basal bones, but evidently they are somewhat adaptable.
2. Muscle can be stretched 25 per cent of its length without altering its function, but this stretching has not been demonstrated as possible with the present orthodontic treatment methods.

V. Deflection of the Mandible.

1. Tooth interference or temporomandibular joint pathologies can cause the mandible to close or open incorrectly.
2. Removal of tooth interference usually is followed by a correction of the muscular pattern to permit normal closure.
3. In some instances, removal of interference is not followed by a correction of the abnormal closing pattern and thus exercises or guidance must be instituted.

VI. Facial Bone and Tooth Size.

1. With the passing of time, there appears to be an increasing discrepancy between the size of the teeth and the facial bones.
2. There are discrepancies in size of teeth in various quadrants and opposing arches of a given patient's dentures, especially in the incisor areas.

VII. Changes in the Vertical Dimension.

1. Vertical dimension may be gained by permitting or producing extrusion of the posterior teeth.
2. Vertical dimension, once gained, is difficult to retain.
3. Loss of vertical dimension is a possible cause for jumbling of the mandibular incisors.

These principles gain significance as they are incorporated into practical treatment procedures.

In contemplating the actual treatment of a dental or dentofacial deformity, it seems reasonable to consider *first* what changes are desirable. These should be indicated by the diagnosis, and usually are planned to be obtained in the same sequence as the factors contributing to the deformity occurred. For example, if incisors are jumbled because of the narrowing of the dental arches, expansion, if permissible, would be gained prior to any attempt to align the incisors. If, on the other hand, the incisors are jumbled due to shortening of the arch mesiodistally, the length is regained when practical and then alignment of the incisors is started. Second, we should consider what changes are possible;

third, which of the possible changes are worth the effort; and, fourth, whether the changes produced will be stable.

While teeth can be moved in any direction, changes in the bony base are supposed to be limited to the alveolar area. It is undoubtedly true that appliances cannot grow bone beyond the inherited potential but, in effect, they can by permitting and enhancing bone growth through the elimination of inhibitions during the growth period, and, in addition, they can redirect the bone growth. Small facial bones can be induced to grow up to, but not beyond, their inherited growth potential, and force derived from appliances should be able to inhibit growth of bones that otherwise would be oversized because of an exaggerated inherited potential or a pathologic urge. After the growth period, surgery must be resorted to for changes in the basal bone.

While it can be done, there is question in the minds of some whether it is worth it to carry out the following procedures:

1. Move teeth posteriorly en masse if the result will be impaction and, therefore, necessary removal of the third molars, when elimination of first premolars would achieve an equally good esthetic and functional result with less time spent in treatment.
2. Strive for normal interdigitation of posterior teeth when, for example, good esthetics and function is possible in certain Class II deformities if the maxillary first premolars are removed and the incisors carried lingually and distally with the remaining maxillary posterior teeth left in the Class II interdigitation with the mandibular posteriors.
3. Bring badly impacted canines into position, especially if premolars must be eliminated to permit it.
4. Reopen spaces for bridge or partial restorations where space has closed because of failure of certain teeth to form or where permanent teeth have been lost early.

On the other hand, some believe it is desirable to open the bite or increase the vertical dimension, even though, for maintenance, it means the wearing of a bite plate the rest of the patient's life. This is particularly true of those close-bite deformities for which it is desirable and possible to produce further eruption of the posterior teeth without exceeding the normal freeway space. Of course, it is hoped that, after prolonged wearing of the bite plate, the various structures will adapt and come into equilibrium in this new position so that the bite plate eventually may be discarded. However, it has never been successfully demonstrated that the bite will remain open once increased vertical dimension has been achieved unless a bite plate is worn at least intermittently.

Class II, Division 1 dentofacial deformities lend themselves well for a discussion of treatment principles and methods. A typical Angle Class II, Division 1, although variously defined, generally is considered to be a deformity characterized by protruding maxillary incisors and a mandible in

distal relation to the maxilla, due to deficient growth of the mandible. In a typical deformity of this type, according to many orthodontists, the main objectives of treatment are:

1. Movement of the maxillary posterior teeth distally and the incisors lingually.
2. Stimulation of the mandibular growth, especially at the head of the condyle.

Although most believe that the only way to stimulate condylar growth is to have the mandible held forward of its usual position, there is lack of agreement as to how this should be accomplished. One author[1] states that, according to the Angle plan of treatment, the maxillary posterior teeth should be carried distally into correct interdigitation with those of the mandible, even though by so doing the maxillary posteriors are carried beyond their normal position in the skull. The idea is that, by establishing correct interdigitation of the posterior teeth, force will be produced during function to drive the mandibular teeth mesially, which force will be enhanced by the tendency of the maxillary posterior teeth to return to their former positions. However, during the movement of the maxillary teeth distally, mandibular anchorage previously gained is guarded zealously in order to prevent labial and mesial migration of the mandibular teeth, and the condyle is supposed to remain in its accustomed position in the glenoid fossa so that there will be no disturbance of the original muscular activity. Just how the condyle could grow while maintained in its accustomed position rather than being held forward, or how muscles could be stimulated to accommodate if mandibular growth does occur, is not stated. Another author[2] believes that the condyles, through intermaxillary elastic force, should be held forward of their former position during the distal movement of the maxillary teeth, while still another[3] evidently does not believe the mandible should receive *any* mesial force, since he employs only occipital resistance for maxillary distal tooth movement.

Undoubtedly, the mandible is held some mesially during the wearing of Class II intermaxillary elastics, and this may result in either mesial shift of the mandibular teeth relative to the basal bone or, possibly, growth at the head of the condyle. Some, in order to achieve condylar growth, resort to guide planes or other similar devices, often producing a gratifying result.

If condylar growth and muscular adjustment is desirable in Class II Angle deformities, it would seem only logical to produce a force that would actively cause the mandible to be held mesial of its accustomed position. Since it has been demonstrated that forward growth of the maxilla or its denture can be inhibited by distal forces,[4] and since it is possible that desirable muscular action and condylar growth may result from mesial forces, it would seem that both should be utilized. If it is true that a bone, such as the mandible, cannot be stimulated to grow beyond its inherited potential, this would not have to be feared.

Therefore, in the treatment of Class II, Division 1 Angle deformities in which the mandible is deficient or distally malpositioned, force should be applied

in a distal direction to the maxilla and in a mesial direction to the mandible. If intermaxillary elastics are to be worn, the stabilizing plate appears to offer the best resistance against undesirable mandibular tooth movement while permitting the mandible to be held forward. The modified Andresen appliance can supply both the distal maxillary and mesial mandibular force, but usually it is worn only at night and does not possess the variety of treatment possibilities of some other appliances. The application of cervical or occipital force to the maxilla only, in the treatment of a typical Class II, Division 1 Angle case, eliminates the possibility of actively stimulating mandibular growth or desirable muscular change.

If it is desired as part of the treatment to inhibit or encourage growth, it naturally would follow that it is only possible while growth is active, which, in turn, means early treatment. Synchronizing treatment with puberty has merit, according to some who believe that there is a growth spurt in the dentofacial structures at that time. If true, and if the start of puberty could be determined for a given individual, worth-while changes should be a possibility.

In conclusion, it may be said that treatment should comply with known facts gleaned from clinical experience and research.

Appliances should be designed to produce the desired result in the easiest and best manner possible, from the standpoint of both the patient and the operator.

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THE EFFECT OF HIGH KILOVOLTAGE ON HARD AND SOFT TISSUE DEFINITION IN LATERAL CEPHALOMETRIC ROENTGENOGRAMS

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INTRODUCTION

THIS is a preliminary report of a series of experiments in high kilovoltage and very low milliamperage radiation exposure time in lateral cephalometric roentgenography. Because cephalometric roentgenography is being accepted more and more by orthodontists as a valuable aid in prognosis, diagnosis, and treatment planning, it would be most desirable to have both the soft and hard tissues registered on the completed lateral cephalometric roentgenogram. It was with that objective in mind that this experimentation was carried on.

The usual technique[1] followed by many operators in making lateral cephalometric roentgenograms utilizes the radiation exposure of 60 KVP, 20 Ma. for two and one-half seconds. This exposure factor varies somewhat, depending on the age of the patient. These roentgenograms show very little or no soft tissue definition. However, various techniques have been employed to obtain this soft tissue rendition. Some operators expose two films (a non-screen film and a screen film) simultaneously in the same cassette or film holder, and then superimpose the developed films on one another to obtain the soft tissue outline draping over the skeletal structure. Others paint the faces of the patients with a somewhat radiopaque substance prior to the x-ray exposure to obtain the soft tissue outline.

According to the most radiologic techniques, a low kilovoltage is necessary for good soft tissue definition. That is true if only the soft tissue rendition is the objective. However, with this low kilovoltage technique, the hard tissues are very poorly defined. It followed, then, that by increasing the kilovoltage, and thereby proportionately increasing the penetrating power of the x-rays, the hard tissues should be better defined, but, then again, this resulted in the soft tissues being lost on the developed film. Obviously the solution could not be found in methods just mentioned. How to meet that challenge? Could one "eat one's cake and have it too?" That meant investigation. However, if one was to experiment, one should be fortified with a fundamental knowledge of the properties of roentgen rays. Therefore, at the risk of being redundant, a short review of these phenomena follows.

Read before the American Association of Orthodontists Chicago, Illinois, May 16-20, 1954.

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PROPERTIES OF MATTER

To better understand the radiographic phenomena, it is well to review some of the fundamental knowledge of physics and chemistry[3] pertaining to matter as we know it now. The subject itself is quite involved, but extremely fascinating; but we shall only pass over the highlights and fundamentals, for it is through the characteristic properties of matter that roentgen rays are produced.

To begin with, what is matter? Matter is made up of discrete particles consisting of molecules and atoms which are in a constant state of agitation, which agitation increases with the rise in temperature. In speaking of the various known ninety-two elements, the molecule, which is made up of atoms, is the smallest physical unit of an element which can exist. The atom, which is the chemical unit of the element, consists of a *positively* charged nucleus surrounded by *negatively* charged electrons sufficient in number to neutralize the nuclear charge. It is these electrons which play the stellar role in the production of x-rays. In order to appreciate the extreme smallness of atoms, a comparison can be made. The size of atoms and extremely short roentgen and other rays are measured in angstrom units, named after the Swedish physicist, Anders Jonas Angstrom (1814-1874). To illustrate the minuteness of measurement, let us examine the copper atom. It is 2.54 Å in diameter. If you multiply that unit by 100,000,000 times, it would equal 1 inch. A comparable magnification of a grapefruit would equal the size of the earth. Table I will show some interesting equivalents.

TABLE I

EQUIVALENTS	DIAMETER MEASUREMENTS	WAVE LENGTHS
1 micron (μ) = .001 mm.	Atoms vary from 0.74 Å to 5.24 Å	Roentgen rays = 0.05 Å to 8.0 Å
1 angstrom (Å) = .0000001 mm.	Erythrocytes vary from 6μ to 9 μ or 60,000 Å to 90,000 Å	Visible light = 3,500 Å to 7,000 Å
1 angstrom (Å) = .001 μ		

Now let us return to the atomic structure (Fig. 1). The atom is quite an open structure with the dense nucleus occupying only about .0001 part of the diameter of the whole atom. Practically all the atomic weight of the atom is that of the nucleus. The atomic weight of an atom varies directly proportional to its atomic number. The atomic structure resembles our solar system. The nucleus of the atom, *positively* charged, being the sun; and the electrons, *negatively* charged, and attracted to it, being the satellites. An element, as stated before, is composed of atoms widely spaced within the element with some free, unattached, negatively charged electrons floating around. The whole thing is in a constant state of flux. Heating or electrically charging the element increases the agitation of its atomic structure. The elements[4, 7] differ from each other solely in the "atomic number" of their atoms. The "atomic number" of a neutral atom represents the number of positive nuclear charges balanced by an equal number of negative electrons. Some examples

to illustrate: the atomic number of hydrogen is 1, while that of tungsten is 74; copper has the atomic number of 29; uranium, the heaviest of all known elements and the most important element in atomic energy, has the largest atomic number, 92, and the heaviest atomic weight, 238.07. That is to say, that the aforementioned elements have 1, 74, 29, and 92 negatively charged electrons to the positively charged nucleus of each atom, respectively.

This brings us to the electric current. What is it?

When a metal conductor is energized with electricity, the current passing through this metal is said to be a stream of electrons. The individual electrons in this stream can be considered the smallest unit of an electric current. The electron is also the smallest known particle in the universe.

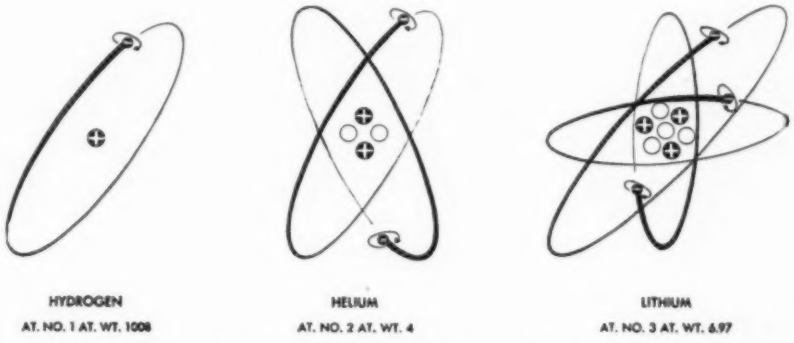

Fig. 1.—Atomic structure. (From Military Roentgenology Manual, published by the War Department.)

> "A good conductor is said to be so constituted that its electrons readily become detached from the parent atoms and migrate through the material. Insulators are regarded as substances in which the electrons are bound so firmly to their atoms that they cannot be made to travel through the material except under the action of powerful forces. It is believed that only negative electricity moves in a metal."[4]
> One of the poorest conductors of electricity is glass.

Copper, whose copper atoms have the atomic number 29, is one of the best conductors of heat and electricity, with a low melting point of 1981.4° F. (1083° C.). Tungsten, with an atomic number of 74, is a poor conductor of electricity, but has the highest melting point of all metals, 6098° F. (3370° C.). Hence, it is used as the cathode filament and the target of the anode in the modern x-ray tube.

ROENTGEN RAYS

Roentgen Rays.—How are they produced (Fig. 2)?[2, 4] The small filament of tungsten wire in the cathode end of the tube is heated to incandescence to about 3240° F. At this temperature, there is a spontaneous emission of electrons. With a further increase in temperature, more electrons are emitted. Then, as a high voltage current is passed through this filament, these electrons are hurled against the tungsten spot (focal spot) of the anode to complete the circuit. This stream of electrons, also called the cathode rays, bombard this

target at tremendous speeds. The speed at which these electrons travel depends on the kilovoltage. The greater the kilovoltage, the higher the speed. As these electrons (from the cathode) hit the tungsten anode, some of the electrons (less than 2 per cent) collide with the other electrons or atom nuclei of the anode, and the result of this collision produces the roentgen rays in various wave lengths. The rest of the electron stream passes into the tungsten target between the atoms and produces tremendous heat.

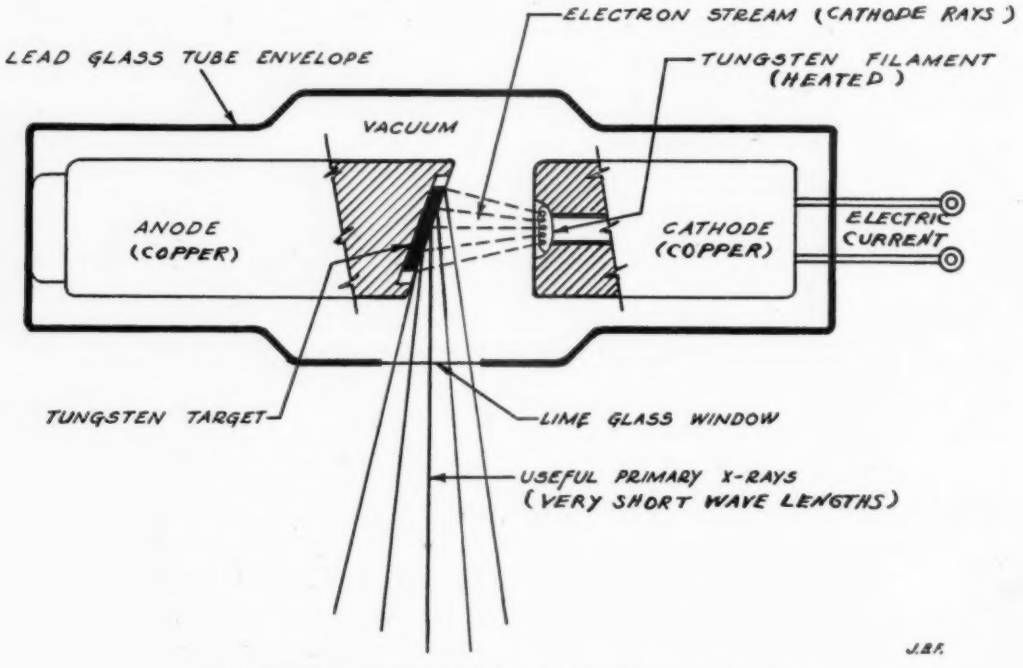

Fig. 2.—Diagram of Coolidge x-ray tube in operation.

> "Roentgen rays are characterized by their *intensity* and by their wave length. Intensity designates quantity of radiant energy, while wave length describes quality. In general, short wave lengths are more penetrating than long wave lengths."[4]

A STANDARDIZED HIGH KILOVOLTAGE TECHNIQUE

It was observed that in the early stages of film development the soft tissues were clearly defined, and as development continued these soft tissues disappeared and the hard tissues became more clearly defined. That meant that the soft tissues were registered on the film. However, to stop the development of the film when the soft tissues appeared would result in the loss of the hard tissue definition. That, of course, would not do.

It is known also that the milliamperage determines the density or blackness of the developed film, and that kilovoltage affects contrast. Also the higher the kilovoltage, the greater the penetration of x-rays. It is reasonable to expect, then, that if one increases kilovoltage and conversely decreases

milliamperage radiation time, one might "pick up" the soft tissues as well as the hard tissues. Of course there were other radiation factors to be considered. This was discussed in a previous paper.[9] Fortunately, I have an x-ray machine[1] in which I can control the kilovoltage and milliamperage output (Fig. 3). The machine is capable of delivering 10 to 30 Ma. and 40 to 100 kv.

Fig. 3.—Electro-timer and controls of x-ray machine.

The effective focal spot is 2.8 mm. square. The timer is electrically synchronized from 1/10 second to fourteen and one-half seconds. At this point, one may add that the ordinary dental x-ray apparatus could not meet these specifications.

The problem was to devise a standardized technique in lateral cephalometric roentgenography which would show the soft tissues draping over the skeletal framework without losing good definition of bone tissue and its important landmarks. This would be very desirable and would add diagnostic

Fig. 4.

Fig. 5.

Fig. 4.—Lateral cephalometric roentgenogram of patient J. F., aged 12 years, 2 months. Exposure data: 60 kv., 20 Ma. for two and one-half seconds. Film was completely developed. Note lack of soft tissue definition.

Fig. 5.—Lateral cephalometric roentgenogram of patient J. F., aged 12 years, 2 months. Exposure data: 60 kv., 20 Ma. for two and one-half seconds. Film was incompletely developed. Note that soft tissues are defined but hard tissues are very poorly defined.

value to the picture. Investigation was carried on with that point in view, and the answer seemed to be in increasing the kilovoltage. Of course, with high kilovoltage, there should be a concomitant decrease in milliamperage and exposure time.

Experiments were carried on by gradually increasing the kilovoltage and decreasing the milliamperage seconds. As the kilovoltage was increased and milliamperage seconds decreased, more of the soft tissue was being "retained" on the roentgenogram. Additional experimentation suggested that there must be some optimum of exposure.

As in all experiments, while seeking one objective other interesting phenomena are brought in the picture. In this instance, the factor of radiation hazards[5, 6] to both patient and operator could not be ignored. This was also checked and explored. It was demonstrated that the high kilovoltage technique of 90 kv., 20 Ma. for 3/10 second subjected both patient and operator to considerably less radiation hazard than the usual exposure technique of 60 kv., 20 Ma. for two and one-half seconds. The results of this investigation have been published.[9]

Fig. 6.—Lateral cephalometric roentgenograms of patient J. F., aged 12 years, 2 months. Exposure data: 90 kv., 20 Ma. for 3/10 second. Note hard and soft tissue definition brought out utilizing high kilovoltage technique. The film was completely developed.

As has been stated, during a radiographic exposure all tissues, soft and hard, are registered on the film. The conditions under which the radiographic exposure is made determine which tissues will be ultimately defined on the completely developed roentgenogram. To illustrate, three lateral cephalometric roentgenograms were taken of the same subject, as shown in Figs. 4, 5, and 6. In Fig. 4 the exposure factors were 60 KVP, 20 Ma. at two and one-half seconds. The film was completely developed. Note that only the hard tissues are defined on this film. The soft tissues have been lost. In Fig. 5 the radiation exposure factor was the same as in Fig. 4. However, this exposed film was incompletely developed. Development was stopped when the soft tissues appeared. Note the lack of hard tissue definition. In Fig. 6 the radiation exposure factor was 90 KVP, 20 Ma. at 3/10 second. The film was completely developed. Note that the soft, as well as the hard, tissues are

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

Figs. 7 to 14.—Cephalometric roentgenograms all taken at 20 Ma., 90 KVP, 3/10 second.
Fig. 7.—Boy (D. S.) aged 5 years, 7 months.
Fig. 8.—Girl (R. S.) aged 7 years, 3 months.
Fig. 9.—Boy (L. M.) aged 8 years, 2 months.
Fig. 10.—Boy (M. R.) aged 10 years, 5 months.

defined on the film. The technique of 90 KVP, 20 Ma. at 3/10 second may not be the optimum procedure for soft and hard tissue definition in lateral cephalometric roentgenography; nevertheless, there is the suggestion that high kilovoltage may be the answer.

Fig. 11.

Fig. 12.

Fig. 11.—Boy (H. D.) aged 11 years, 2 months.
Fig. 12.—Girl (R. R.) aged 12 years.

Utilizing the high kilovoltage technique of 90 KVP, 20 Ma. at 3/10 second, thirty-four roentgenograms were made up of subjects ranging in age from 5 years, 7 months to 69 years, 6 months. Some of these are shown in Figs. 7 to 14. These films were analyzed by the General Electric X-ray Corporation for film densities by the Ansco-Sweet Photoelectric Densinometer (Table II). The density readings 1-2 and 3 in the Herter-Driffeld scale represent the amount of visible light that can show through a film layer, namely 10 per cent, 1 per cent, and 0.10 per cent, or .10, .01, and .001. Readings were made of the background (the black portion of the film), bone tissue (condylar area), and soft tissue (region of the lip). The blackness of the background area indicates

the completeness of the development of the film. This was used as a basis of comparison. The background densities, you will note, ranged from 1.80 to 2.60. The greater part of the sample averaged 2.37. The human eye cannot distinguish small fractional densities. For example, the difference of 2.19 from 2.38 is 0.19, and the human eye cannot measure that difference. Please note in this table of density measurements that the soft tissue and bone tissue

Fig. 13.

Fig. 14.

Fig. 13.—Boy (R. S.) aged 13 years, 8 months.
Fig. 14.—Boy (E. J.) aged 15 years, 7 months.

readings vary very little *regardless* of age. This was a startling discovery. To illustrate further, please note the soft tissue and hard tissue readings of the various ages in Table III.

The variable difference in densities, please note, is not very discernible to the eye. Apparently, this phenomenon is contrary to the laws of physics. I do not believe it is. The explanation[1] may be the effect of the high kilovoltage

TABLE II

SEX	AGE		SKELETAL WIDTH IN MILLIMETERS		BACKGROUND DENSITY*	SOFT TISSUE DENSITY*	BONE DENSITY*
	YEARS	MONTHS	CRANIUM AT N-S LEVEL	BODY OF MANDIBLE FROM GO TO PGO			
F	5	7	167	65	2.52	2.20	0.84
F	6	4	168	67	2.14	2.00	0.86
F	7	10	163	68	2.02	1.82	0.74
M	8	2	175	76	2.24	1.96	0.70
F	8	3	168	78	2.40	2.12	0.69
M	9	6	180	73	1.80	1.64	0.44
F	9	9	176	68	2.60	2.32	0.84
F	9	11	169	73	1.92	1.68	0.72
F	10	2	170	65	2.38	2.16	0.80
M	10	3	173	73	2.40	2.20	0.98
M	10	5	180	75	2.16	2.06	0.74
M	11	2	183	78	2.32	2.18	0.84
M	11	2	181	73	2.40	2.30	0.76
M	12	3	182	80	2.60	2.50	1.06
F	12	6	174	72	2.50	2.40	0.96
M	12	8	170	71	2.29	2.13	0.90
F	13	5	164	68	2.19	1.96	0.74
F	13	8	177	78	2.01	1.76	0.60
F	14	4	182	80	2.22	2.06	0.86
F	14	4	173	72	2.22	2.01	0.64
M	14	5	166	78	2.20	1.98	0.64
M	14	9	175	81	2.06	1.84	0.60
F	15	1	177	86	2.32	2.09	0.65
M	16	1	185	80	2.52	2.32	0.95
F	16	6	186	83	1.80	1.72	0.64
M	16	7	183	81	2.11	1.90	0.60
F	17	6	176	80	2.59	2.42	0.66
F	21	3	178	78	2.36	2.18	0.60
F	21	3	181	80	2.10	1.90	0.88
F	21	9	182	88	2.01	1.72	0.64
F	25	1	183	82	2.32	2.09	0.64
M	34	1	194	80	2.21	2.00	0.48
F	45	0	185	78	2.44	2.32	0.63
M	69	6	196	83	2.22	2.12	0.52

*Densities measured with an Ansco-Sweet Densitometer (photo cell).

TABLE III. DENSITOMETER READINGS

AGE		BACKGROUND	SOFT TISSUE	HARD TISSUE
YEARS	MONTHS			
8	3	2.40	2.12	0.69
10	5	2.16	2.06	0.74
14	4	2.22	2.01	0.64
15	1	2.32	2.09	0.64
21	3	2.36	2.18	0.60
25	1	2.32	2.09	0.64
45	0	2.44	2.32	0.63
69	6	2.22	2.12	0.52

penetration on the subject which sets up a greater secondary radiation emitted by the subject with the resultant effect on the film.

CONCLUSION

An attempt has been made to show the results of these experiments by photographing the roentgenograms. I hasten to add that it is extremely

difficult to preserve details when photographing x-rays. You will notice in the photographic print the great loss of soft tissue detail in the transference. Please note that the roentgenograms are of persons from 5 years, 7 months to 69 years, 6 months of age (Figs. 7 to 14). The exposure time, milliamperage, and kilovoltage were the same for all; namely, 3/10 second, 20 Ma., and 90 KVP. The films were all developed in the usual manner. There does not seem to be much difference in the density of the respective films. This is the technique I am now using. There seems to be a suggestion that as one goes up into the higher kilovoltages, the contrasting range becomes broader and the films less dense. That means that there must be practical limitations to the diagnostic value of such films. It should be remembered that the foregoing is a preliminary report. More investigations are being carried on with the use of aluminum filters. It is hoped that the high kilovoltage technique may be further improved.

SUMMARY

1. The conventional radiation exposure technique (that is, 60 KVP, 20 Ma. for two and one-half seconds in cephalometric roentgenography) does not result, usually, in good soft tissue definition.

2. Matter is composed of an element or combination of elements. Elements are composed of molecules and atoms. Molecules are composed of atoms. Atoms are composed of positively charged nuclei and negatively charged electrons.

3. The electron is the smallest known particle in the universe, and the smallest unit of an electric current. Bodies, compounds, or elements, when charged with electricity or heated, emit electrons. A stream of electrons, also called cathode rays, generated in the x-ray tube, produces a form of energy upon bombardment of the opposite electrode, the anode. The form of energy is mostly heat and less than 2 per cent roentgen rays (x-rays).

4. Roentgen rays are invisible and have the speed of light or electricity. Roentgen rays are characterized by their intensity and by their wave length. Intensity designates quantity of radiant energy, while wave length describes quality. In general, short wave lengths are more penetrating than long wave lengths.

5. A x-ray machine more powerful than a dental x-ray machine is desirable. An x-ray should be so calibrated that the operator can manually control the milliamperage and kilovoltage. Such control is usually not incorporated in a dental x-ray machine.

6. Milliamperage and kilovoltage are important factors in x-ray radiation. The milliamperage determines the density or blackness of a film. Kilovoltage brings out the contrast between hard and soft tissues. Milliamperage is the dangerous factor in x-ray radiation and should be reduced wherever feasible. The higher the kilovoltage, the greater the penetration.

7. A high kilovoltage and a very low milliampere-second technique results in a better definition of soft tissues, at the same time retaining good hard tissue rendition. With this exposure factor there is a great reduction in exposure time and x-ray radiation hazard to both patient and operator.

8. In this preliminary report the suggested high kilovoltage standardized technique for cephalometric roentgenography using focal-midline cephalostat distance of 60 inches, the exposure radiation factor in 90 KVP, 20 Ma. for 3/10 second for all orthodontic subjects, regardless of age. There seems to be very little difference in film densities of all anatomic landmarks at various age levels.

9. More clinical experimentation is indicated to further improve this high kilovoltage technique. At the present time I am carrying on further investigations with the use of aluminum filters.

Much valuable aid and cooperation was given me by certain personnel of the General Electric X-ray Corporation. I want to thank these men, E. Dale Trout, John Kelly, Frank Dreisinger, and Don V. Philleo, for their personal interest and cooperation. I am grateful also to Mrs. Gunnar Ryge, photographer at Marquette University Dental School, for her valuable assistance.

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EFFECTS OF MAXILLARY BITE PLANE THERAPY IN ORTHODONTICS

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REVIEW OF LITERATURE

BITE plane," "bite plate," or "bite block" are terms descriptive of a variety of devices that have been used for orthodontic treatment or to facilitate such treatment. Usually they are removable by the patient, but they may be fastened to the teeth. As a general rule, they are fabricated to fit the patient's palate, but they may be designed to slip over the coronal portions of the teeth. As will be seen, they have been used for a variety of purposes, but this article relates to their use as a means of preventing the full closure of the jaws by providing, in the anterior region, an artificial surface against which the lower incisors strike when the jaws are brought together.

As early as 1771 an inclined plane, to be worn on the lower anterior teeth, was described by John Hunter.[25] This device was constructed of wrought silver; its purpose was to move lingually locked upper incisors labial to the lower incisors. Joseph Fox,[25] in 1803, advocated the removal of the force of occlusion before attempting to move teeth. This he accomplished by placing a bite block over the posterior teeth. Henry Clay Quinby,[26] in 1883, illustrated a form of maxillary bite plate "to take pressure off the back teeth so as to allow them to elongate." He also concluded that this reduction of anterior overbite would provide room for the lingual movement of the upper incisors. W. G. Bonwill,[26] in 1889, illustrated and described a maxillary bite plate. "The intent was not only to drive the inferior incisors up into their sockets but also to allow the bicuspids and molars to come down and antagonize before the plate was removed." N. W. Kingsley's[12] bite plane, described in 1892, was the first maxillary inclined plane to be described in literature for the purpose of jumping the bite. This device was to be used to cause the mandible to move forward bodily from a posterior Class II to a normal Class I relationship. Kingsley[26] mentioned the bite plane in 1879, but failed to elaborate on it at that time. Although not mentioned by him, his bite plane certainly would have had the effect of decreasing overbite, as does the flat maxillary plane.

The benefits, as well as the dangers, of using the maxillary bite plane to effect a reduction of overbite have been discussed by numerous authors in dental and orthodontic publications. A few articles are based on scientific

Thesis submitted as partial fulfillment of the requirements for the degree of Master of Science in Orthodontia in the Graduate College at the Chicago Professional Colleges of the University of Illinois, 1953.

investigations, but most consist of the citing of clinical experience only and provide no specific material or data to substantiate the varied theories behind their use.

Claims for the value of the bite plane have been inconsistent. Depression of the lower incisors, as well as eruption of maxillary and mandibular molars have been suggested and denied. Permanent increase of vertical facial height has been mentioned but not substantiated. At least a temporary increase of facial height would be obvious if accelerated molar eruption followed. Invariably some changes in one or more areas were noted, but such changes have never been checked against growth without such treatment.

The various observations can be conveniently grouped under *Empirical* and *Scientific*.

Empirical.—Rogers[16] used the maxillary bite plane in conjunction with myotherapy for a number of years. He suggested in one of his later papers that "a decrease in overbite, desirable in many distoclusion cases" could be accomplished by the use of a maxillary bite plane. Davenport[7] noted that bite planes could be used for correction of deep overbite and felt that the result was an eruption of molars and other posterior teeth. Jackson[11] concluded that a depression of the lower incisors was the action of the bite plane. Mershon[15] studied bite plane therapy extensively and believed that some degree of change could be accomplished with the bite plane, but that the permanent effect would be a depression of the mandibular incisors. He stated that in deep overbite, "a typical picture shows posterior teeth which are long with deep cusps and an exaggeration of the curve of Spee as the result of an apparent over-eruption of the lower anterior teeth." He claimed that vertical face height could not be permanently changed by bite plane therapy and substantiated this hypothesis by quoting Mackenzie: "Muscle is dominant. It cannot shorten or lengthen and it cannot remain under tension indefinitely. Therefore, the other tissues change and adapt themselves until the muscles are relieved of all strain." Strang,[21] in a discussion of a paper by Hemley[8] on bite plates, stated, "I have felt from clinical experience that the bite plate really did elevate the molars and produced a growth of alveolar bone in this area; that it had no effect along the lines of depressing the incisors and if that effect was present it was not of sufficient degree to counterbalance the good work that was accomplished by the use of the bite plane." Hopkins[10] in reference to the "guide plane"* wrote, "It opens the bite for the possible vertical growth in the molar and premolar region." Salzman[17] attributes the following changes to the use of the bite plane:

1. "Forward positioning of the condyle of the mandible on the eminentia articularis.
2. "Opening of the bite, diminishing the overjet of the anterior teeth.
3. "Elevation of the posterior teeth; the anterior teeth may be slightly depressed or both.

*A fixed maxillary inclined plane.

4. "A more normal antero-posterior relationship of the occlusal relationship.
5. "Facial outline is usually improved."

Scientific.—Wolfson[28] was one of the first to publish evidence based on measurements. He used a maxillary splint in four cases to decrease the overbite. Measurements were made on dentofacial casts with the conclusions that:

1. "Deep overbites of the type presented, upon treatment, show a major change in the anterior region only, and apparently more markedly in the mandibular teeth.
2. "The problem of vertical growth is one of excessive eruption of the anterior teeth, rather than a lack of growth in the posterior teeth."

Wolfson's methodology, particularly in the observations and measurements of the lower incisors, is indefinite and open to question. Hemley[8] presented a detailed study of physiologic reaction due to bite plane therapy using physical measurements made directly on the patient. He found that there was generally no change in the vertical height of the lower anteriors and that there might even be slight eruption. A definite increase of lower molar height was noted. Maxillary molar change was not studied. Breitner[2] studied the results of increasing vertical dimension on monkeys, using caps on the maxillary anterior teeth in lieu of the bite plane. Histologic slides of these animals revealed changes in the temporomandibular joint area, at the gonial angle of the mandible, and around all the teeth. This work suggested changes to conform with the dictates of environment and credited these changes with a reduction in the overbite together with local effects. This work is in agreement with that of Todd,[24] who observed that the morphology of a structure may, to a degree, be a reflection of environmental factors. Bahador and Higley[1] concluded that "most of the vertical increase was shown in the posterior dental region. More cases showed vertical increase in the maxillary posterior teeth than in the same area of the mandibular arch." Very little, if any, intrusion of the lower incisors was noted. This study is commendable but lacks the support of a control group; therefore, as in the previous investigations, the changes recorded could well have been due to normal development.

The possibility of an increase in vertical dental height after occlusion was corroborated by Schour[18]: "Apposition of cementum and secondary dentine are continous and permit the efficient adaption of the tooth to changing conditions." Cole[6] noted that, particularly in extraction cases, overbites reduced by treatment tended to return. This observation was substantiated by Litowitz[14] who remarked, "In cases of deep overbite it was evident that teeth can be depressed by orthodontic procedures. However, such teeth return to at least their original height in every case; in some they exceed it." The original degree of overbite did not always reappear; in fact, it decreased after treatment in several cases. This work lacked control and apparently did not account for normal growth and eruption.

Almost all the works listed have the same common failing; that is, they are not controlled by studies of groups of persons of comparable age levels who

were not subjected to the experimental procedure. There is, therefore, no way of knowing how much of the observed phenomena may be credited to the results of the therapy and how much must be credited to growth and eruption. The reports of a few such investigations are, however, available in the dental literature. These may be used as control observations.

Carlson[5] studied the rate and amount of eruption of all the mandibular teeth from central incisor to first permanent molar in five persons. This was a cephalometric roentgenographic study that covered the entire age range from the earliest appearance of the tooth bud in the x-ray picture to the closing of the root ends following complete eruption. The usefulness of Carlson's work is limited, however, by the smallness of his sample (five cases). He noted that all teeth studied erupted at a comparatively rapid rate until occlusion was reached. At this time eruption diminished noticeably and proceeded only as rapidly as the occlusal plane rose. This contention was supported by Hoffman and Schour[9] using vital stains, roentgenographs, and histologic examinations on rats. Weinmann[27] also noted a similar pattern of eruption of deciduous and permanent teeth. That the occlusal plane is quite stable in its angular relation to the lower border of the mandible, the palate, and the anterior cranial base was established by Brodie.[4]

Since the demonstration by Brodie[4] of the constancy of mandibular positioning and the subsequent work by Thompson and Brodie[23] and Thompson,[22] which indicated that the teeth had little to do with such positioning, interest has been focused on the path followed by the mandible as it traveled from its position of rest to that of full dental occlusion. At the rest position the teeth of the two jaws are separated by an interval which has come to be known as the interocclusal or "freeway" space. This varies widely between individuals and Wylie[29] has shown that there is a significant difference between total molar height in slight and extreme incisal overbites, the severe overbites being associated with decreased molar height.

The deleterious effects of the deep overbite on the human dentition have long been recognized clinically. The mandible, restrained in its lateral excursions, is forced to function in an almost vertical manner, bringing undue stress on certain teeth while leaving others almost functionless. More recently attention has been directed toward the possible effects of the deep overbite on normal development of the dental arches and alveolar processes.

In man, as in most mammals, the lower dental arch closes within the upper arch; that is, the lower incisors pass up the inside surfaces of their maxiliary antagonists. This sets up labial forces on the upper and lingual forces on the lower incisors. The extent of this closure is dependent on the level at which the premolar and molar teeth contact. Since the anterior teeth taper (that is, become thicker) from their incisal edges to their gingival portions, it follows that the deeper the overbite, the smaller the arc to which the lower incisors must accommodate, and hence the greater the lingual forces operating on the lower incisors.

This factor becomes of extreme importance during the transition from the primary to permanent dentition. The lower incisal segment of the dental arch must accommodate permanent teeth which are almost one-third larger than their predecessors. Robbed of the possibility of making sufficient adjustment to this demand by a deep overbite, the permanent incisors are forced to erupt into insufficient space with resulting crowding, rotations, or the complete blocking out of entire teeth. The permanent teeth of the upper arch tend to conform to the smaller size of the mandibular arch and a pattern of malocclusion is set up that is extremely difficult to manage by anything but prolonged and intricate therapy.

Kloehn[13] and others have reported on cases in which, following the placement of bite planes, crowded conditions of the lower incisal area have been partly or completely relieved. This has pointed to the possibility that the control of the overbite by very simple procedures might prevent in larger measure the development of some of the more severe malocclusions and hence bring the benefits of orthodontics within the reach of large numbers of people at present unable to afford it.

MATERIAL

This investigation is based on a roentgenographic cephalometric study of two groups of children: a control group and a treated group. All headplates were taken with the Broadbent-Bolton cephalometer, using the Broadbent technique.[3]

The control group consisted of forty-seven headplates of normal children between the ages of 6 and 18 years, selected on the basis of age span, quality of headplates, and absence of orthodontic interference. Five of these were from the files of the Bolton Study, Western Reserve University; the remainder from the files of the Department of Orthodontia, University of Illinois. Each child was represented by two headplates, the interval between headplates varying from ten months to nine years and ten months. The majority spanned an interval of six to nine years.

The treated group consisted of thirty patients. Twenty of these were from the waiting list of the Department of Orthodontia, University of Illinois; one was from the Department of Graduate Pedodontics, and nine were from the Department of Orthodontia clinic. Several of the latter patients were undergoing simultaneous cervical anchorage treatment with traction applied to bands on the maxillary sixth year molars. The maxillary molars of these cases were not included in the study and teeth not in full occlusion before treatment were omitted. The selection was made at random from an age group of 7 to 14 years, all having deep overbites in the incisor region. No attempt was made to screen the group for normal or malocclusions. Selection of deep overbites automatically eliminated Class III (Angle) occlusions.

METHOD

The usual orthodontic records were made of all the treated cases, before treatment. These consisted of full alginate impressions of both dental arches,

intraoral roentgenograms, cephalometric head roentgenograms, and photographs. For each patient a bite plane was made from acrylic resin (Fig. 1). This was a simple covering of the palate closely adapted to the necks of the teeth and thickened anteriorly to a flat plane, parallel to the occlusal surface of the teeth, and permitting the lower incisors to close to a level 1 to 2 mm. beyond the incisal edges of the uppers, automatically creating an open-bite in the posterior dental area. The patient was instructed to wear this bite plane continuously.

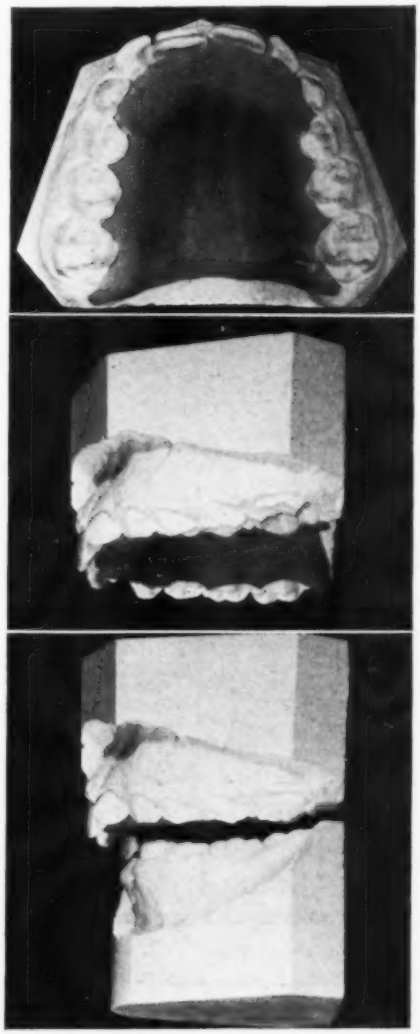


Fig. 1.—Illustration of the appliance used.

Lateral head roentgenograms were taken again as soon as clinical changes became apparent. This was based on observations of the closing of the molar teeth to occlusion. Additional material was added to the bite plane in a few patients requiring a further decrease of overbite, or in patients showing evidence of considerable abrasion of the plane. When the anterior overbite was

decreased to a normal amount (1 to 2 mm.) or the maximum attainable during this period of treatment, final head roentgenograms, impressions, wax bites, intraoral roentgenograms, and photographs were taken.

For purposes of comparison, all lateral headplates of both treated and control groups were traced and the following measurements (Fig. 2) were made with a Boley gauge, accurate to 0.1 mm., and a standard protractor, accurate to 1 degree:

1. Height of mandibular molar above lower border of mandible.
2. Height of maxillary molar below nasal floor.
3. Height of mandibular incisor above lower border of mandible.
4. Height of maxillary incisor below nasal floor.
5. Angle formed by the occlusal plane and the lower border of the mandible.

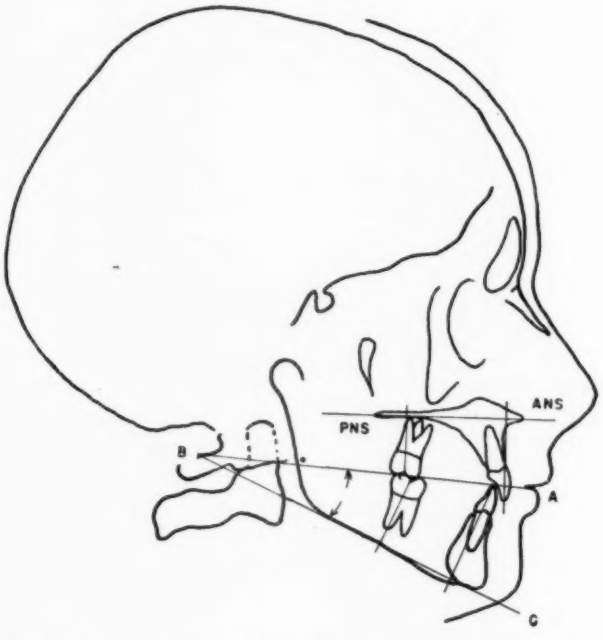


Fig. 2.—Points, planes, and angles used in this study.

The exact points of measurements and the methods of establishing planes and angles are set forth in the following glossary.

GLOSSARY

1. *ANS*—Anterior nasal spine.

2. *PNS*—Posterior nasal spine.

3. *ANS—PNS*—Points through which the base line for the study of eruption of maxillary teeth was drawn.

4. *AB*—A line representing the occlusal plane at the left first permanent molars and the incisal tip of the lower left central incisor.

5. *BC-Mandibular Plane*—A line tangent to the most inferior point of the symphysis and the lower border of the left body of the mandible at the gonial angle.

6. *Occlusal Plane*—The line AB.

7. *Occlusal Angle (ABC)*—That angle formed by the intersection of the lines AB and BC.

8. *Upper Molar Height*—Measured from ANS—PNS to AB on a perpendicular to ANS—PNS through the buccal groove of the left first permanent maxillary molar.

9. *Upper Incisal Height*—Measured from ANS—PNS to the incisal tip of the left maxillary central incisor along a perpendicular to ANS—PNS through the incisal tip of the left maxillary central incisor.

10. *Lower Molar Height*—Measured from the mandibular plane to the occlusal plane on a perpendicular to the mandibular plane through the midpoint, mesiodistally, of the lower molar.

11. *Lower Incisor Height*—Measured from the mandibular plane to the incisal tip of the lower left central incisor on a perpendicular to the mandibular plane.

12. *Overbite*—The amount of overlap of the upper incisor teeth over the lower incisor teeth.

The greatest difficulty encountered in the making of comparable measurements was found in the lack of strict conformity of the experimental and control groups. The intervals between roentgenograms of the control group were in terms of years, while those between the roentgenograms of the treated children were in months. It was necessary, therefore, to make the assumption that eruptive growth in the normal child was at a steady rate, and to arrive at the monthly interval by fractionating the annual rate. The legitimacy of this procedure seemed justified by the findings of Brodie,[4] Carlson,[5] Hoffman and Schour,[9] and Weinmann.[27]

Additional information was derived from the intraoral roentgenograms, from the before and after models of the treated cases, and from an objective examination of the patient. This consisted of qualitative observations of the effects of treatment on root and alveolar structures, reaction of gingival tissues to treatment, and measurements of the changes in arch length and width.

The mean rates of eruption of the molars and mandibular incisors in the treated patients were so widely different from the values found in the control group and those of the eruption of the maxillary incisors were so similar to the values of the control group that statistical methods of evaluation scarcely seemed necessary. Nevertheless, they were checked for statistical significance. The following formula was used in computing "t" for comparison of the mean eruption of the various teeth.

$$\text{"t"} = \frac{m_1 - m_2}{\sqrt{\frac{s_1 + s_2}{n_1 + n_2 - 2} \cdot \frac{n_1 + n_2}{n_1 \cdot n_2}}}$$

Where m_1 and m_2 are the sample means.

n_1 and n_2 are the numbers of cases in the samples.

$s_1 - s_2$ = The sum of the squares of the deviations of the indi-

vidual scores from the means of their respective samples.

Fisher's "t" table was entered with (n – 1) degrees of freedom. Changes were accepted as significant when the probability (P) was less than .05.

FINDINGS

This study revealed several facts that are of value in assessing patient reaction to maxillary bite plane therapy. These facts will be considered according to their source.

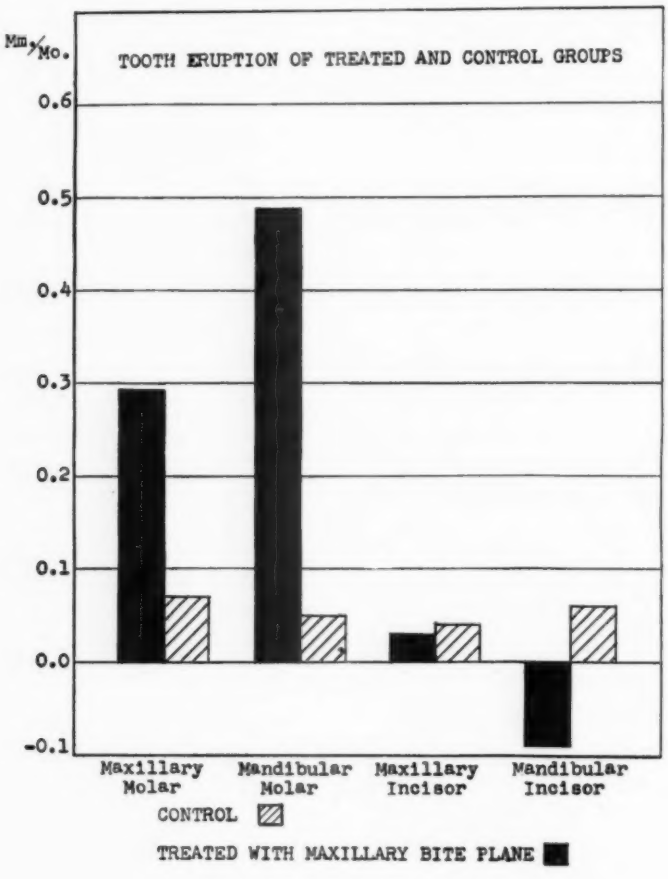


Fig. 3.—Before molars regained occlusion.

Control Group.—(Data taken from headplate tracings.) The occlusal plane, as used, was quite stable with only a slight tendency for the angle between it and the lower border of the mandible to increase. As was expected, all the teeth studied displayed some degree of eruption (Fig. 3).

There were variations of eruptive rates between patients and between individual teeth within patients. However, when the means were considered the following facts were noted: in the mandible the rate of eruption of the

incisors was slightly greater than that of the molars, while in the maxilla molar eruption exceeded that of the incisor to a small degree; a comparison of incisor eruption revealed that the lower incisor erupted at a slightly greater rate than did the upper incisor; in contrast to this, the upper molars erupted at a slightly greater rate than did the lower molars (Table I).

Treated Group vs. Control Group.—(Data taken from headplate tracings taken during the period in which the bite plane prevented posterior occlusion. See Table I and Fig. 3.) The angle between the occlusal plane and the lower border of the mandible decreased in all cases.

TABLE I. RESPONSE OF VARIOUS DENTAL UNITS TO BITE PLANE THERAPY*

TOOTH INVOLVED	NUMBER	MEAN ERUPTION PER MONTH (MM.)	STANDARD DEVIATION OF MEAN	"t"	PROBABILITY
		Control Group			
$\frac{\lvert 6}{\lvert 6}$	46 47	0.07 0.05	± 0.022 ± 0.020	4.44	Less than .01
$\frac{\lvert 1}{\lvert 1}$	39 45	0.04 0.06	± 0.025 ± 0.026	3.64	Less than .01
$\frac{\lvert 6}{\lvert 1}$	46 39	0.07 0.04	± 0.022 ± 0.025	5.47	Less than .01
$\frac{\lvert 6}{\lvert 1}$	47 45	0.05 0.06	± 0.020 ± 0.026	0.20	More than .5†
		Control Group vs Treated Group			
$\frac{\lvert 6}{\lvert 6}$	46 20	0.07 0.29	± 0.022 ± 0.26	3.32	Less than .01
$\frac{\lvert 6}{\lvert 6}$	47 29	0.05 0.48	± 0.020 ± 0.28	7.50	Less than .01
$\frac{\lvert 1}{\lvert 1}$	39 28	0.04 0.03	± 0.025 ± 0.17	0.20	More than .05†
$\frac{\lvert 1}{\lvert 1}$	45 30	0.06 –0.09	± 0.026 ± 0.20	2.73	Less than .05

*Before buccal segments regained occlusion.
†Not significantly different.

Mean maxillary molar eruption was increased. The maximum monthly increment noted was +0.9 mm. and the minimum was 0.0 mm. The difference between control and treated means was 0.22 mm. per month.

Mean mandibular molar eruption was increased. The maximum monthly increment noted was +1.1 mm. and the minimum was +0.1 mm. The difference between control and treated mean was 0.43 mm. per month.

Maxillary incisor eruptive rate was not significantly altered. Considerable change in the rate of eruption of the mandibular incisors was noted, however. In seventeen patients there was an actual depression of the lower incisor; the maximum amount noted being –0.5 mm. per month (one patient). Six patients

did not undergo either eruption or depression. Seven patients indicated continued eruption. The mean rate of the three groups was –0.09 mm., compared to a control rate of +0.06 mm. per month (Figs. 4 and 5). Variability of patient cooperation defeated any attempts to correlate response to treatment with patient age.

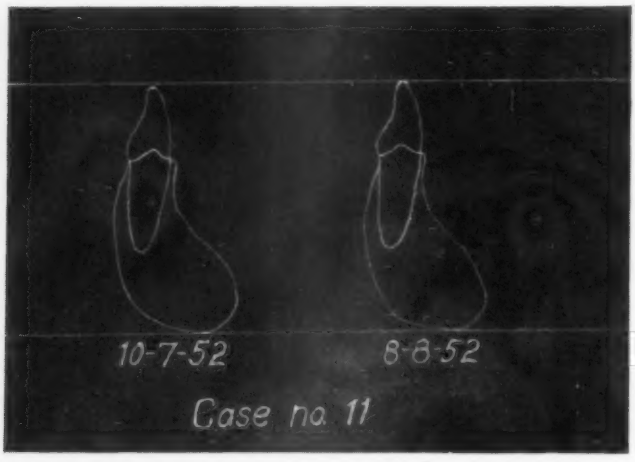


Fig. 4.—Contact print of tracing of lower incisor before and after treatment.

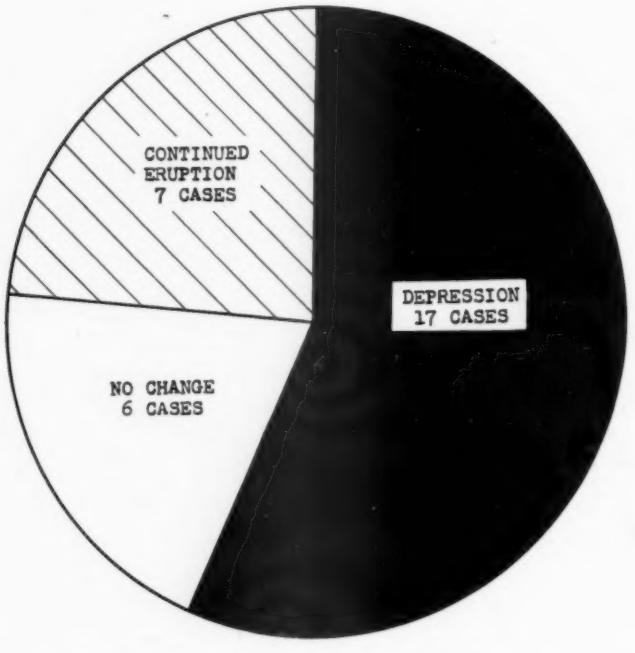

CONTINUED ERUPTION 7 CASES
DEPRESSION 17 CASES
NO CHANGE 6 CASES
REACTION OF MANDIBULAR INCISORS TO BITE PLANE THERAPY

Fig. 5.—Reaction of mandibular incisors to bite plane therapy, before molars regained occlusion.

Treated Group.—(Data taken from headplate tracings embracing the total observation period.) Results of the study of changes noted during the time when the bite plane prevented occlusion of the posterior teeth indicated that tracings over the entire period of observation would be of interest. The patients selected were those with the greatest number of head roentgenograms

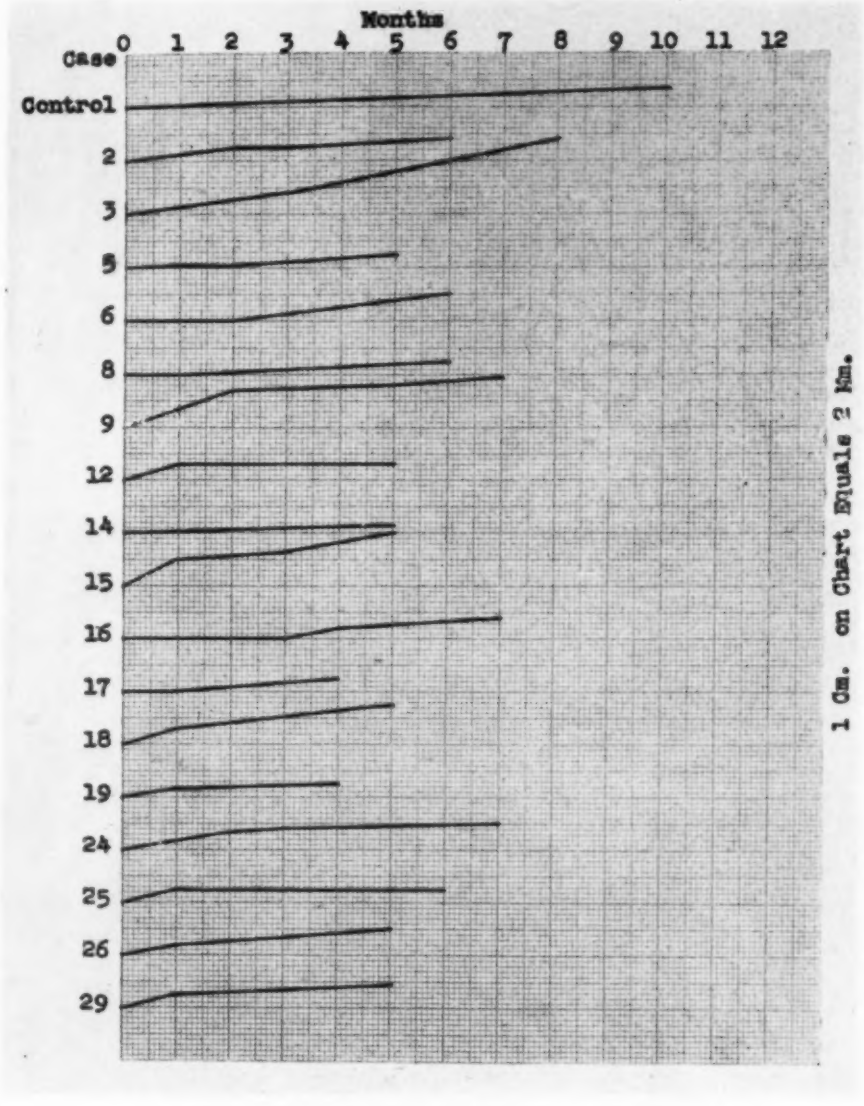


Fig. 6.—Eruption of maxillary molars in treated cases.

taken over the longest period of time. Many of these patients had attained posterior occlusion, at least during lateral excursion, by the time the third headplate was taken. The maximum time interval was eight months. The greatest number of head roentgenograms taken was five during a treatment time of seven

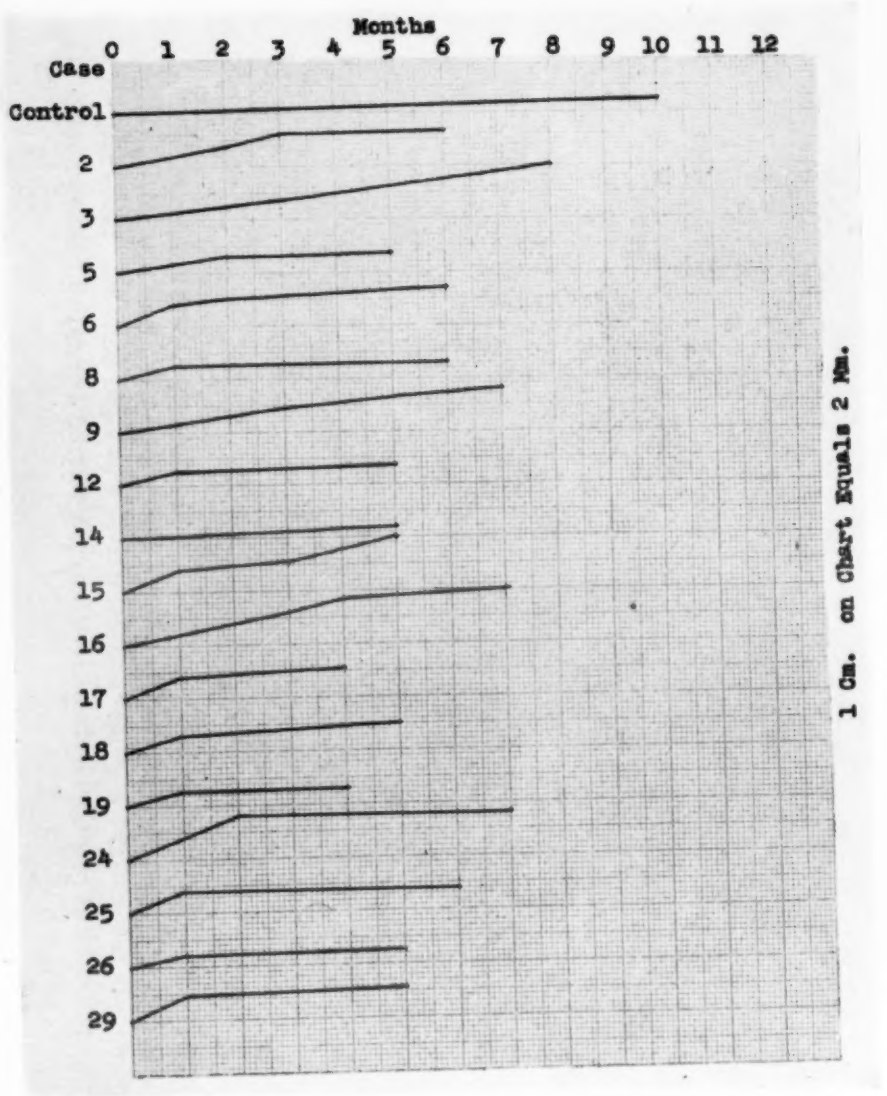


Fig. 7.

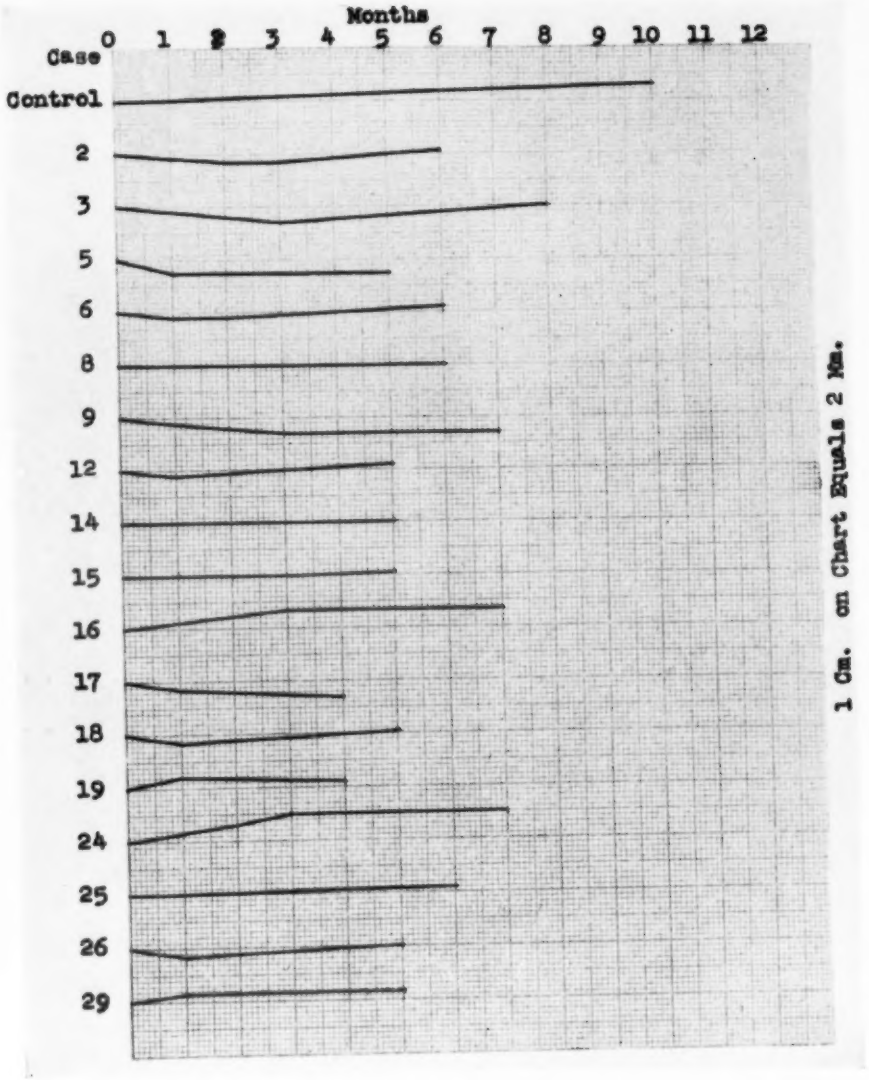


Fig. 8.

Fig. 7.—Eruption of mandibular molars in treated cases.
Fig. 8.—Vertical changes of mandibular incisors in treated cases.

TABLE II. CHANGES NOTED IN TREATED CASES
(EXTENDED OBSERVATION)

CASE NO.	TIME IN MONTHS	$\overline{6}$ (MM.)	$\overline{6}$ (MM.)	$\overline{1}$ (MM.)	$\overline{1}$ (MM.)
2	0	17.2	27.0	26.0	39.5
	2	17.0	27.7	26.0	39.2
	3	17.7	28.2	26.0	39.2
	6	17.8	28.3	26.3	39.6
3	0	17.8	30.1	30.0	45.8
	3	18.0	30.8	30.8	45.2
	8	20.0	32.1	29.0	45.8
5	0	14.9	25.3	27.8	38.5
	1	15.0	25.6	28.0	38.0
	2	15.0	25.9	28.0	38.0
	5	15.4	26.0	28.4	38.0
8	0	20.6	27.0	22.4	42.8
	1	20.6	27.5	22.4	42.8
	6	21.1	27.6		42.8
9	0	17.3	23.2	22.5	35.9
	2	18.7	22.7	22.5	35.5
	3		24.1	22.4	35.3
	5	18.9	24.5	22.6	35.3
	7	19.2	24.8	22.6	35.3
12	0	18.2	28.8	28.2	40.2
	1	18.8	29.3	28.0	40.0
	5	18.8	29.5	28.5	40.0
14	0	21.7	32.0	34.0	46.0
	5	22.0	32.4	34.0	46.0
15	0	13.0	22.6	27.3	34.0
	1	14.0	23.4	27.3	34.0
	3	14.3	23.7	27.3	34.0
	5	15.0	24.6	27.0	34.1
16	0	19.6	31.0	24.2	40.8
	3	19.6	32 2	24.6	41.5
	4	20.0	32.7	24.6	41.5
	7	20.4	33.0	25.0	41.5
17	0	18.0	25.7	29.7	36.0
	1	18.0	26.5	30.0	35.7
	4	18.5	26.8	30.2	35.4
18	0	15.0	28.6	26.0	40.6
	1	15.6	29.2	26.0	40.3
	5	16.5	29.6	26.2	40.7
19	0	16.5	29.5		36.8
	1	16.8	30.0		37.2
	4	17.0	30.1		37.0
24	0	16.8	23.0	26.5	34.6
	2	17.5	24.6	26.5	35.2
	3	17.6	24.6	26.6	35.6
	7	17.8	24.6	26.8	35.6
25	0	17.8	29.6	23.4	43.2
	1	18.3	30.4	23.5	43.2
	6	18.3	30.4	24.0	43.4
26	0	17.0	28.2	32.8	42.6
	1	17.4	28.6	32.8	42.4
	5	18.0	28.7	32.4	42.6
29	0	20.8	25.0	32.8	37.5
	1	20.8	26.0	32.8	37.8
	5	21.7	26.1	33.1	37.8

Changes referred to in columns 3, 4, 5, and 6 are measurements of vertical movements of the respective teeth.

Eruption of mandibular molars in treated cases.
Vertical changes of mandibular incisors in treated cases.

months. In all these cases there was noted a tendency for the eruption pattern to revert to a rate more comparable to that of the control group as soon as the posterior teeth began to have even limited contact with their opponents (Table

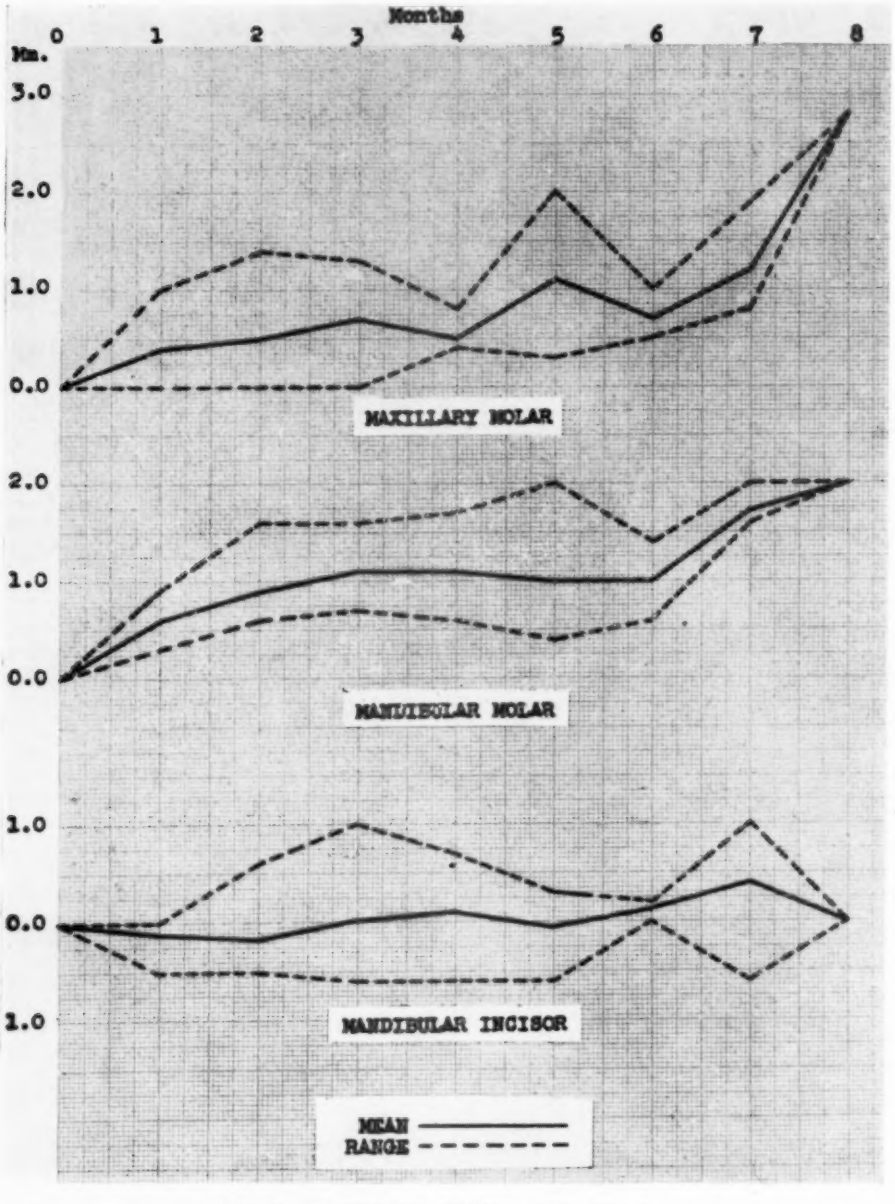
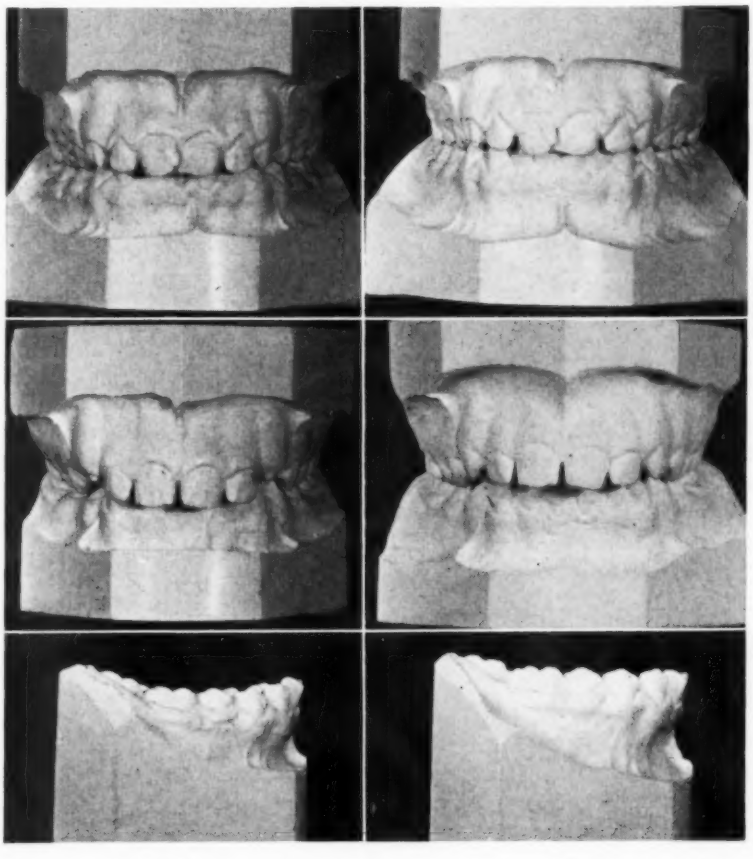


Fig. 9.—Composites of Figs. 6, 7, and 8.

II and Figs. 6, 7, 8, and 9). Final measurements of maxillary incisor height were not graphed, since activated labial wires were added to several of the bite planes after the first changes were noted.

Treated Group.—(From examination of the models, Fig. 10.) Anterior overbite was decreased in all cases. The amount varied from 1 mm. to 4 mm.

This reduction was due to vertical dental changes and to the expansion noted in all maxillary buccal segments. This expansion was not found in the lower arch (Table III). The inevitable result was cuspal interference and an exaggerated reduction of overbite. Several models occluded in a more favorable anteroposterior position subsequent to the initiation of treatment, but none changed from a Class II to a Class I relation. There was evidence of increased mandibular arch length in most cases as a result of labial tipping of mandibular



A. *B.*

Fig. 10.—Three separate cases, from top to bottom. *A*, Before treatment; *B*, after treatment.

incisors, as well as uprighting of mandibular molars, particularly where mesial tipping had occurred following premature loss of deciduous posterior teeth. The mandibular occlusal curve was reduced in varying amounts by incisor depression or decreased rate of eruption and accelerated permanent molar eruption.

Oral Examination of Treated Cases.—No change was apparent upon examination of gingival tissues except in those cases previously irritated by contact of the lower incisors with the palatal tissues. The latter cases improved clinically.

TABLE III. CHANGES OF ARCH WIDTH NOTED IN TREATED CASES*

CASE NO.	TIME IN MONTHS	3-3 (MM.)	6-6 (MM.)	6-6 (MM.)
2	6	+0.2	+1.0	+0.1
3	8		+2.0	+0.1
5	5	+1.0†	+2.0	0.0
6	3	+0.9†	+1.5	0.0
8	6	+1.2	+4.0	+0.2
9	6	+1.0	+1.5	0.0
12	4	+1.7	+4.0	0.0
14	8		+1.0	+0.2
15	5	+1.5†		0.0
16	7	+1.0	+1.0	0.0
17	4	+1.4	+1.0	0.0
18	5	+1.0	+2.0	+0.3
19	4	+0.5†	+1.0	+0.2
24	8	+1.5†	+2.2	+0.3
25	6	0.0	+0.7	0.0
26	5	+0.5	+1.2	0.0
29	5	+0.2	+1.3	0.0

*Maxillary bite plane only—no auxiliary devices.
†Deciduous teeth.

None of the patients noticed any sensitivity or soreness of the teeth, gums, or musculature. All stated that they were more comfortable with the appliance in place, except at mealtime. This difficulty in mastication was apparent only until the posterior teeth were again in occlusion. There was a wide range of cooperation between patients. Some apparently wore the appliance continuously; others obviously wore it only part of the time. Several admitted removing it while eating.

Intraoral Roentgenograms.—No significant changes were noted in the x-ray pictures taken before and after treatment.

DISCUSSION OF FINDINGS

That a reduction of anterior overbite can be accomplished through the use of the maxillary bite plane is common knowledge. This fact was noted by Quinby[26] and probably by others before him. The reasons for this reduction have not been firmly established. Bonwill,[26] Salzmann,[17] Hemley,[8] Breitner,[2] and Bahador and Higley[1] have indicated that the modifications are a combination of molar eruption and mandibular incisor depression or inhibition in varying degrees. That depression of the mandibular incisors alone is responsible for the change was mentioned by Jackson,[11] Mershon,[15] and Wolfson.[28] That molar eruption accounts for the improvement noted seems to have been the opinion of Davenport,[7] Strang,[21] and Hopkins.[10] These are but a few of the many opinions.

This study was designed to test the effectiveness of maxillary bite planes on the dentition; however, other possible changes are unavoidably included. No consideration has been given to the possibility of changes in the region of the temporomandibular joint, the gonial angle, related musculature, or other associated parts. Mershon,[15] Breitner,[2] Rogers,[16] and Salzmann[17] have suggested that such changes may occur.

The findings noted in the control study are self-explanatory.

Comparison of data from the treated and nontreated series head roentgenograms revealed a statistically significant response to treatment in three areas. Mean maxillary and mandibular molar vertical height increase were accelerated. Mean mandibular incisor eruption rate was reversed. These observations correlated well with the findings of Thompson and Brodie[22, 23] regarding normal freeway space; that is, those cases displaying absolute depression of mandibular incisors may well have been violations of normal freeway space. In the physically immature patient this depression ultimately will be expressed as a retardation of mandibular incisor eruption in a growing face. An increased rate of molar eruption may be temporarily expressed as precocious development, the eventual posterior dental height being determined by the individual genetic pattern. At this point it may be well to note the possibility that minor changes in form will be more closely associated with preadolescent treatment than with adult treatment.

Wylie[29] has noted a deficiency of molar height in patients with a deep anterior overbite. This suggests a hereditary factor which possibly limits permanent changes to a diminution of the over-all vertical growth potential of the mandibular incisors. The works of Litowitz[14] and Cole[6] question the permanency of depression of lower incisors, but since these studies lacked control it is difficult to refute this means of varying the denture pattern.

That the eruptive rates of all teeth involved in this study tended to return to normal as soon as posterior occlusion again became effective was to be expected. It is conceivable that if normal freeway space was exceeded, the eruption of all the teeth would be slowed as they came into full occlusion. This retardation would be effective until muscular and skeletal growth progressed sufficiently to accommodate the treated occlusion.

It has been suggested that when occlusal interference is eliminated vertical dental height increases will result in expansion of the maxillary buccal segments and contraction of the mandibular buccal segments. This is attributed to the buccal inclination of the upper and lingual inclination of the lower molars. A study of the anatomy of the maxillary molars indicates that only a part of the expansion of the upper arch can be attributed to tooth inclination. Most of the buccal expansion can be credited to the direct action of the appliance which is actually an inclined plane formed between the convex lingual surface of the maxillary teeth and the cervical portion of the bite plane. Under these circumstances, eruption must be expressed in a buccoocclusal direction. It is conceivable that the effect of this inclined plane may even be carried onto the alveolar process. This expansion of the upper arch related to a relatively stable lower arch results in the lingual cusps of the maxillary teeth riding up on the buccal cusps of the mandibular teeth. An illusion of spectacularly rapid reduction of overbite is derived from this action. Logically, lower expansion should eventually follow upper expansion if the bite plane is worn over an extended period of time.

The action of the appliance in expanding the upper arch may explain the lesser degree of vertical response of the upper molars in comparison to the lower molars; that is, maxillary molar eruption may have been expressed in a buccoclusal vector, while mandibular molar eruption was confined to an occlusal vector. Undoubtedly the rates noted in the control group will again be in effect as soon as there is a balance of the associated skeletal and muscular parts.

Anterior tipping of the lower incisors is due to a release from the lingual force provided by the inclined planes of the lingual surface of the upper incisors, also by the action of the lower incisors striking the bite plane at a slight angle in many cases. This action was also noted by Kloehn.[13]

There was a variable response of the deciduous teeth to the therapy used. In general, however, the deciduous molars did not erupt as rapidly, when released from occlusal forces, as did the permanent molars and premolars. This observation was prompted by an apparent lack of occlusion of many of the deciduous molars, even after the adjacent permanent molars were in occlusion. The premolars reached their antagonists at approximately the same time as did the adjacent molars.

Increased facial height noted by various investigators is probably a temporary by-product of local changes. Brodie's[4] observations regarding the stability of the lower border of the mandible make permanent changes in facial height unlikely, since the mandible's natural position is at rest and not in occlusion.

Variations in the curve of Spee were inevitable with the eruptive changes produced.

Uprighting of the lower molars suggests that lower space maintainers may not be required when a maxillary bite plane is in place. Further study is necessary to substantiate this thought.

The large range of values obtained from the treated cases was due to uncontrollable variables, the greatest being the cooperation of the patient.

SUMMARY AND CONCLUSIONS

Thirty cases employing maxillary bite planes for the reduction of deep overbite were studied clinically and by means of tracings of cephalometric roentgenographs in an attempt to make a quantitative and qualitative analysis of the resultant changes.

Data accumulated from this treated group were compared to similar data from a control group of forty-seven cases. The changes in question were: eruption rates of the maxillary molars and incisors and mandibular molars and incisors, and angular changes of the occlusal plane with reference to a control group. Measurements of change were converted to monthly increments to facilitate comparison. A survey of the findings revealed: (1) little change in the rate of eruption of the maxillary incisor; (2) a marked increase in the eruptive rate of maxillary and mandibular molar teeth with a slightly greater ratio of vertical change noted in the mandibular molars; (3) there was signifi-

cant change in the occlusal plane; (4) the eruptive changes tended to return to normal rates as molar occlusion again became effective; (5) in the majority of cases mandibular dental arch length was increased by labial tipping of the lower incisors, (6) maxillary expansion was noted in all the cases measured.

The bite plane is capable of decreasing the amount of overbite through an alteration of the normal process of dental development. The effect of musculature, occlusal forces, and growth upon the permanence of this therapeutic measure is open to speculation as are the etiological factors involved. Certainly one factor to be considered is normal freeway space. It is possible that induced eruption of posterior dental units will allow them to occupy any excessive freeway space available. On the other hand, it is difficult to understand why normal eruption does not take advantage of this space if it is actually an excess. I have the feeling that freeway space is often normal for an individual, even though it may be more than average in height, and any attempt to reduce this space will eventually be followed by relapse.

The usefulness of the maxillary bite plane is extremely limited unless accompanied by other measures which will provide for normal incisor function and occlusion. Permanency of results may well depend on early treatment, patient cooperation, resultant incisal occlusion, adaptability of the interocclusal space, and the length of the retention period.

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Erratum

In the article entitled "Orthodontics in Public Health Practice" by Harry Strusser and Louis A. Simon, which appeared on page 654 of the September, 1954, issue of the JOURNAL, the names of two contributors were inadvertently omitted.

The patients mentioned in the letters printed on pages 661 and 662, and the patients in Cases 1 and 2, shown in Figs. 1 through 4, were treated by Dr. Jacob C. Lifton, an orthodontist of New York City. Case 3 (Figs. 5 through 9) was treated by Dr. Jacob Z. Strum, prosthodontist, of Brooklyn, New York.

Editorial

Orthodontics' Weakest Link*

MUTUAL confidence and friendly cooperation between operative dentist and orthodontist have become a reality. To say that such a relationship is universal would be untrue. To overlook the many instances of mutual admiration and understanding between operative dentist and orthodontist would be disputing fact. The effect upon the patient and parents is highly gratifying. The layman's confidence grows as a multiple of this reciprocal respect between dentists, and happy will be the day when all patients will have explicit confidence in dental services. During recent years the value of dental services has increased greatly in the estimation of the layman. A big factor in this development could be the realization on the part of the public that dental education is excellent and that the dental profession, through the American Dental Association, is working collectively to improve the quality of dental services.

I am wondering if orthodontists are doing their part to assure the public that they, too, are collectively interested in all orthodontic patients and are working together for the benefit of the public. Just as fine cooperation between operative dentist and orthodontist insures patient confidence, so cooperation between orthodontists enhances public confidence in orthodontics. This cooperation can be best displayed or disastrously contradicted by one of the most neglected techniques in the orthodontic profession. I refer to the technique of patient referral from one orthodontist to another.

A patient referral offers one of the greatest opportunities an orthodontist has to strengthen and improve public confidence in orthodontics and orthodontists. A patient happily transferred from one orthodontist to another has been made doubly happy and therefore has complete confidence in orthodontics. On the other hand, one patient disillusioned and deeply hurt by careless and often inexcusable referral procedure can do enough harm to the orthodontic profession to offset the good will produced by a great many well-treated cases.

Is it not about time that orthodontists pay more attention to this weakest link in their professional technique? Is each orthodontist responsible for doing his utmost to introduce a referral patient properly to his new ortho-

*The Great Lakes Society of Orthodontists appointed a committee to make recommendations to that Society as to ways and means of referring orthodontic patients under treatment from one orthodontist to another.

Dr. Scott Holmes, past-president of the Great Lakes Society, discussed this subject in his presidential address (published in the July, 1954, issue of the AMERICAN JOURNAL OF ORTHODONTICS and this discussion inspired considerable reader comment.

For the added reason that this particular subject is causing a great deal of comment in the general scheme of things orthodontic, the editorial staff asked Dr. Scott Holmes of Muskegon, Michigan, to write this guest editorial on this subject.

dontist? Is there an orthodontist who would not direct a total stranger to his destination if the person inquired of him? How much greater, then, is the orthodontist's responsibility to a patient who has placed confidence in his professional ability! I believe it is the responsibility of every referring orthodontist to make a sincere effort to contact a competent orthodontist in the new locality, and to do it before the patient starts on his way. It is just as important that the accepting orthodontist recognize the correspondence and treat the referral with the greatest respect.

If there is a question of possible difference of opinion as to appliance therapy, it is the duty of the referring orthodontist to explain to the parent that since orthodontic appliances are the instruments of the orthodontist, the new operator must have the privilege of choosing his own appliances. The parent must be advised that different operators conscientiously prefer using different techniques, and that the referring orthodontist must not attempt to dictate procedure to another orthodontist any more than he would tolerate being dictated to. Housewives would thoroughly resent encroachment on the sanctity of their kitchens. On the other hand, the accepting orthodontist should avoid radical change unless absolutely necessary. The Golden Rule is still a pretty good measuring stick. Fairness by both orthodontists is absolutely essential, and differences of opinion should be resolved between orthodontists and not through the medium of the patient.

Now, how about a definite technique? To date the best plan is a rather detailed correspondence between referring and accepting orthodontists. Some believe there is a possibility of simplifying and standardizing this technique without reducing its effectiveness. The Great Lakes Society of Orthodontists has a committee working on this problem. The thought is that a complete, uniform procedure for patient referrals between orthodontic practices is desirable. It is believed that such a technique would go a long way toward convincing the public that orthodontists are just as interested in completing a case as they are in placing the first appliance, even though circumstances dictate that the patient change location.

The Great Lakes Society sincerely hopes that other component societies will recognize the seriousness of this problem and help orthodontics mend its weakest link—but quick.

In Memoriam

FRED E. SIMS

1877-1954

FRED E. SIMS was born in Ponca, Nebraska, in 1877. Dr. Sims received his education through high school in Des Moines, Iowa. He attended Drake University, Des Moines, Iowa, and Western Dental College, Kansas City, Missouri, receiving his degree in dentistry in 1905.

He was licensed to practice in Iowa, Kansas, Missouri, Arkansas, and Oklahoma. He established general dental practice in Weatherford, Oklahoma, where he practiced with his brother, Dr. Everett E. Sims, until 1918. Novocain

FRED E. SIMS

dermatitis forced him to abandon his practice and enter business, but a continuing love for dentistry inspired him to return to Northwestern University in 1935 to receive graduate training in orthodontics. From 1936 until his death he continued the active practice of orthodontics in Tulsa.

Dr. Sims was a Mason, Knight Templar, and Shriner, and in 1953 he received the Degree of Knight of the York Cross of Honour, conferred as a past presiding officer of all the York Rite Bodies of Masonry.

He was active in dental and orthodontic society activities, having served four years as secretary-treasurer of his district dental society and vice-president of the Oklahoma State Dental Association. He was chairman of the Committee on Dental Health of the Oklahoma State Dental Association and chairman of the Dental Society Committee on Fluoridation, which committee succeeded in its efforts to obtain fluoridation of the Tulsa water supply. He was, for fifteen years, a member of the Denver Summer Seminar on Orthodontics.

Dr. Sims is survived by his wife, Lodine; two sons, Dr. Hugh A. Sims, who has been associated with him since 1946, and Fred W. Sims, a student at Baylor University College of Dentistry; and one daughter, Mary Sims of Los Angeles, California.

Department of Orthodontic Abstracts and Reviews

Edited by
DR. J. A. SALZMANN, NEW YORK CITY

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York City

A Rehabilitation Program For the Dentally Physically Handicapped Child: By Arthur Bushel, D.D.S., M.P.H., F.A.P.H.A., and David B. Ast, D.D.S., M.H.P., F.A.P.H.A., reprinted (with deletions) from *Am. J. Pub. Health* **43**: 1156-1161, September, 1953.

In 1944 the Division of Orthopedics in the New York State Department of Health was more appropriately reconstituted as the Bureau of Medical Rehabilitation. "With this new acceptance that defects other than orthopedic could constitute physically handicapping conditions, the Bureau of Dental Health saw promise in exploring the problem of dental rehabilitation, particularly of the severely handicapping malocclusions, for the extended nature of orthodontic treatment has been a factor in creating an economic barrier which cannot be hurdled by many families whose children require such attention. Therefore, physically handicapping malocclusion was recognized as a problem coming within the legal provisions of the general state aid rehabilitation program. Accordingly, in 1945 a separate orthodontic care program was initiated, administered by the Bureau of Dental Health."

"Since a large proportion of all children suffer from malocclusions of varying degrees of severity, it became essential to define a 'handicapping malocclusion' and to establish a mechanism for determining the eligibility of cases for state aid. Further, a decision had to be made concerning the professional qualifications for orthodontists participating in the program.

"To help solve these and several other problems, aid was enlisted from the Northeastern Society of Orthodontists. The first step was the appointment of five orthodontists to serve as an Advisory Committee. Their functions have been: to advise the department concerning (1) the classification of handicapping malocclusions and whether or not selected patients fit into this classification; (2) training and experience necessary to qualify orthodontists for participation in the state aid program and the qualifications of individual applicants; (3) an equitable fee scale for orthodontic care; (4) progress of treatment of selected cases; (5) orthodontic educational programs and material for professional personnel, including dentists, physicians, dental hygienists, and other interested health personnel; and (6) to assist the department in preparing instructions to orthodontists regarding progress of treatment, preparation of diagnostic aids, etc.

"In arriving at a workable classification of handicapping malocclusions the Advisory Committee early realized that they could not be too specific or precise in their definitions of malocclusions because of the infinite number of variations possible in malocclusion, and particularly, the individual variation in what constitutes a handicap. It was not possible to arrive at any definition which included simple objective criteria for evaluating the psychological as well as physical factors that create a physical handicap.

"The following classification of handicapping malocclusions was established as a guide in determining the eligibility of cases for inclusion in the state aid program: Malocclusions associated with cleft-palate, cleft-lip, or ankylosis of the temporomandibular articulation; malocclusions resulting from severe structural deformities involving growth and development of the mandible or maxillae, or both: (a) prognathism, (b) retrusion; and (c) micro- or macrodevelopment of the jaws; severe malocclusions resulting from disease or trauma of the mandible or maxillae, or both; and malocclusions resulting in disfigurement or speech defects which may present a serious obstacle to normal development, education and employment of the patient later in life.

"The Advisory Committee faced the problem of recommending the qualifications for those dentists to be enrolled as orthodontic specialists eligible for providing care under the program. In establishing standards, the problem was, on the one hand, to be selective since these orthodontists would be treating particularly difficult cases; on the other hand, it was not desirable to be so restrictive as to cause a shortage of approved orthodontists. It was accordingly established that orthodontists devoting at least 75 per cent of their practice to this specialty were approvable if they qualified under one of the following categories: (1) Those certified by the American Board of Orthodontics or who meet its requirements for certification, (2) active members of the Northeastern Society of Orthodontists or those eligible for membership; and (3) others (not meeting the requirements of the American Board of Orthodontics or the Northeastern Society of Orthodontists) who submit for review five cases which have been carried through to completion. (These must include study and progress models, x-rays, photographs, and detailed history indicating progress in treatment. This material is submitted to the Advisory Committee on Orthodontics for its recommendations as to the applicant's apparent knowledge and ability.) Currently, the roster of approved specialists includes 99 qualified orthodontists in upstate New York and approximately 100 in New York City.

"Potential cases may be brought to the attention of the appropriate local health officer by any interested person, such as a parent, public health nurse, teacher, dentist, dental hygienist, or social worker. As might be expected, public health nurses, school nurses, and school dental hygienists constitute the most active case finders. Special effort has therefore been made to familiarize these groups with the workings of the program and the referral mechanism. On the basis of such referral, the local health officer authorizes a consultation by any licensed dentist of the patient's choice.

"This consultant is requested to examine the child and indicate whether, in his opinion, the malocclusion fits into the established classification of handicapping malocclusions. If the dentist indicates that the case does not come within the scope of the program, it is disapproved unless further appeal is made by some other person who feels strongly that the case should qualify.

"However, if the examining dentist believes the case definitely qualifies, or that it may qualify, he is instructed to submit diagnostic aids for review and is reimbursed $15.00 for this service. The diagnostic aids must include: (1) a full series of mounted dental x-rays; (2) a set of properly prepared study casts; and (3) a true profile and a full-face photograph showing head and neck only, with mouth in rest position.

"These aids together with the written report of the consultation and any other material which may have been submitted are reviewed by the Dental Bureau staff. Cases which leave no doubt as to their eligibility are approved by the director or assistant director. Those which are of boderline eligibility or which present some complicating factor are referred to the advisory Committee for its recommendation. Many cases, particularly those of mixed den-

tition, are disapproved with the recommendation that they be resubmitted when the permanent dentition erupts. The local health officer is notified of the decision by the Bureau of Dental Health. For approved cases, he initiates the procedure for obtaining treatment.

"Care is provided through the Children's Court Act, the law empowering the judge of the Children's Court to order such services. He may either make the cost a full charge against the county of his jurisdiction, or he may order part or full payment by the parent. The cost to the county for care authorized by the court and approved by the Department of Health is reimbursable through state-aid funds to the extent of one-half of its charges. The Department of Health has jurisdiction over all professional phases of the program, while the Children's Courts make all decisions as to financial eligibility.

"On being notified of approval by the Dental Bureau, the local health officer assists the parents in petitioning the Children's Court for care. Care may be provided only by orthodontic specialists on the Health Department's roster, and not more than one year of treatment may be authorized at a time. The maximum fee for first year's treatment is $300 when an orthodontist provides the service in his private office, or $200 when the service is rendered at an approved clinic. More than one year of care is generally required. Accordingly, toward the end of a year's treatment, the orthodontist is requested to submit a progress report. This report includes current information on the course of treatment as well as prognosis. In addition, the orthodontist resubmits the original study casts of the mouth together with new casts indicating the current status. This material is reviewed in the same manner as are original cases and continued care may be approved by court order.

"The maximum duration of treatment approvable in the state-aid program is three years and the maximum fee for each of the second and third years of treatment is $200 for private orthodontists and $120 for approved clinics. Therefore, on the basis of $300 for the first year, $200 for each of the second and third years, a maximum of $700 may be approved for active treatment. Provision is also made for a period of retention care following active treatment at a rate not to exceed $5 per visit for a maximum of 12 visits.

"In addition, some of the malocclusion cases approved for state aid may require other dental services for the complete rehabilitation of the mouth. Fillings, extractions, dentures, and obturators are approvable for such cases. Speech therapy, particularly for cleft-palate cases, is also obtainable through the program.

"It is further recognized that there are oral conditions other than malocclusion and cleft-palate which may constitute a physical handicap. In view of this fact, children requiring full dentures, extensive partial dentures, or other extraordinary dental service to correct a physical handicap may be considered for treatment under the state-aid program. The Veterans Administration fee scale is used as a guide in approving fees for such general dental services, and any dentist licensed in New York State may be approved to provide such care.

"Various types of data have been tabulated to demonstrate the quantitative development of the program. For example, we have seen a steady rise in the annual number of cases applying for care in upstate New York, from 51 in 1946, to 687 in 1951, and 442 for the first half of 1952. During this period of the 2,669 upstate cases reviewed, 1,427 or 53 per cent have been approved as coming within the scope of the program.

"However, in approximately 12 per cent of the new cases approved by the Bureau of Dental Health, court orders were never completed to provide the care. Follow-up of these 169 cases indicates that the primary reason for failure

to issue court orders was the parents' unwillingness to submit to the court procedure. The other major reason was the judge's denial of about 3 per cent of all petitions for first year of care.

"More detailed information regarding the financial aspects of the program is available only since 1949. In 1951, care was authorized for 1,105 children in the amount of $246,673. The average authorization was $223 per child. These figures include the state and county contributions as well as parent payment. A breakdown of these contributions for the first half of 1952 indicates that for upstate New York, 13.2 per cent of the total costs are assigned to parents while in New York City the parents' contribution is only 0.4 per cent. The remaining cost is borne equally by the state and county.

"In view of the fact that up to three years of active orthodontic care may be approved, it is of special interest to determine the actual amount of time required to complete treatment. A study of completed cases indicates that the average duration of treatment has been 1.9 years. This is especially gratifying since the cases treated under this program generally present complex orthodontic problems. It is apparent that the orthodontists providing these services are extremely conscientious and certainly are not attempting to prolong the period of care.

"The cleft-palate/cleft-lip rehabilitation centers are extensions of the dental rehabilitation program. They were established at the Mt. Sinai Hospital in New York City and the Children's Hospital in Buffalo by virtue of contractual agreement with the State Department of Health. Their prime purpose is to evaluate the needs of the cleft-palate/cleft-lip child for complete rehabilitation. These centers fulfill the need for early coordinated consultation by the surgeon, orthodontist, prosthodontist, speech therapist, psychologist, pediatrician, and other indicated specialists. Children may be referred to the centers by local health officers and this diagnostic service is available to such children without fee. For those families that cannot meet the cost for corrective services, the mechanics for providing care are already established through the dental and medical rehabilitation programs.

"The administration of the dental rehabilitation program has not been devoid of problems even after the establishment of apparently sound procedures. There is the occasional orthodontist who does not agree with the department's decision as to the eligibility of a case, the rejected applicant who feels he is being discriminated against in his request for inclusion in the specialist roster, the judge who suddenly cuts off funds so that even cases which have been under treatment are not approved for essential continued care. There is the occasional study model broken in shipment, and the child who proves completely uncooperative and for whom care must be discontinued.

"However, on the whole, the experience with the dental rehabilitation program has been most favorable. The local health officer and his public health nurses are well aware of the benefits of the program as evidenced by their ever-increasing activity in case finding.

"The orthodontists of New York State are apparently also satisfied with the program. The outstanding evidence of their attitude is the fact that almost every qualified orthodontist in upstate New York has asked to participate in the program.

"The patients themselves, and particularly their parents, have been most grateful for the fine care which they could not otherwise have obtained. And the dental rehabilitation program has afforded the Dental Bureau some of our greatest sources of gratification in its work. It is one of the few areas in which administrators of public health programs have been able to approach the type of satisfaction experienced by the clinician.

"The current caseload of about 1,500 for all of New York State represents rapid expansion of the dental rehabilitation program. It also represents a very significant budget item. Even if funds were unlimited, there is the further scarcity of trained orthodontists.

"These facts point to a great need for a preventive approach. Preventive orthodontics is not, as yet, a very well defined field. However, periodic dental care of good quality, starting at an early age, does prevent premature tooth loss and overretention of deciduous teeth which may be etiologic factors in malocclusion. Regular dental care also promotes early detection of malocclusion and follow-up to prevent the development of the more serious orthodontic defects which are often so difficult to correct. It is essential, therefore, that every practicing dentist apply the knowledge in the field of preventive orthodontics and that the orthodontist direct his attention toward developing new preventive procedures.

"For those children who are already dentally handicapped the rehabilitation program offers hope and assurance for normal, happy, and productive lives. The budget investment is sizable, but the dividends to the child and to the community are at the highest continuing level."

"*Acknowledgment.* Earlier in this paper the role of the advisory Committee on Orthodontics was briefly outlined. The group of men who have worked on this committee are deserving of more than casual mention. Dr. Joseph D. Eby, Dr. Lowrie J. Porter, Dr. J. A. Salzmann, Dr. Franklin Squires, Dr. Leuman M. Waugh, and the late Dr. Henry U. Barber have comprised a most conscientious and valuable advisory working group. They helped launch the program by recommending standards which have proved sound in practice. They are so respected within their profession that they speak for it without fear of challenge by their fellow orthodontists. They have provided us with sessions notable for their animation—as well as their duration. This committee, plus our Buffalo consultants, Dr. Walter Ellis and Dr. Clifford Glaser, have made a major contribution to the success of the program."

News and Notes

1954 Research Essay Contest of the American Association of Orthodontists

PRIZE WINNING ESSAY

The Integration of Facial Skeletal Variants: A Serial Cephalometric Roentgenographic Analysis of Craniofacial Form and Growth. S. Eugene Coben, D.D.S., M.S.

Research was done in the Department of Orthodontics, College of Dentistry, University of Illinois, Chicago, Illinois.

Dr. Coben completed his graduate orthodontic training at the University of Illinois in 1952. He graduated from Temple University Dental School in 1949.

HONORABLE MENTION

Width of the Nasopharynx and Related Anatomical Structures in Normal and Unoperated Cleft Palate Children. Jacob D. Subtelny, D.D.S., M.S.

Research was done in the Department of Orthodontics and Cleft Palate Training Center at the University of Illinois, Chicago, Illinois.

HONORABLE MENTION

A Roentgenographic Investigation of the Effect of Orthodontic Treatment on the Relationship of the Alveolar Bone Proper to the Cemento-Enamel Junction. Donald Hodgkins Baxter, D.D.S., M.S.

Research was done in the Department of Orthodontics, University of Washington, Seattle, Washington.

Research Reports Presented at the 1954 Meeting

BONE METABOLISM AND HORMONES

Studies in Bone Metabolism. Milton B. Engel and Daniel Laskin, University of Illinois.

Acceleration of Cranial Growth of Young Rats Following Injection of Somatotrophic Hormones. Gordon R. Meeker, University of Illinois.

DENTO-ALVEOLAR TISSUES

Early Tissue Changes Following Tooth Movement in Rats. Luz C. Macapanpan, University of Illinois.

Eruptive Movements of Lower First Molar in the Rat From 13 Days Insemination Age to 30 Days After Birth. Cyril O'Brien, University of Illinois.

Movement of Vital and Devitalized Teeth in the Macacus Rhesus Monkey. Robert J. Huettner and Robert W. Young, Columbia University.

Length of the Clinical Crowns of Teeth in Malocclusions Treated With and Without Extractions. Robert E. Gibbs, University of Illinois.

A Roentgenographic Investigation of the Effect of Orthodontic Treatment on the Relationship of the Alveolar Bone Proper to the Cemento-Enamel Junction. Donald H. Baxter, University of Washington.

TEMPOROMANDIBULAR REGION

The Development of the Squamoso-Mandibular Articulation in the Rat From 16 Days Insemination Age to 30 Days After Birth. John J. Cunat, University of Illinois.

A Radiographic Study of Various Movements of the Mandible. Elizabeth J. Zwemer, Northwestern University.

An Electromyographical Analysis of Normal Functional Muscle Patterns of the Temporal and Masseter Muscles. Harold T. Perry, Northwestern University.

A Radiographic Analysis of Clinical Determination of the Transverse Axes of the Mandible in Normal, Retruded, and Protrusive Positions on Successfully Treated Orthodontic Patients. Harry C. Good, Northwestern University.

A Clinical and Radiographic Evaluation of a Method of Treatment of Patients Presenting Temporomandibular Dysfunction. Paul E. Draper, Northwestern University.

MORPHOLOGY AND GROWTH OF THE FACE AND TEETH

A Study of the Dentofacial Anatomy in Normal and Abnormal Individuals, Employing Lateral Cephalometric Radiography. Harvey Jenkins, University of Toronto.

Prediction of the Facial Angle in Man. Leonard Frantz, University of Illinois.

A Comparative Study of Several Methods of Cephalometric Analyses in Clinical Orthodontic Diagnosis. Marion F. Dick, Northwestern University.

Cephalometric Evaluation of Vertical Overbite in Young Adults. Frank Popovich, University of Toronto.

An Analysis of Tooth Size, Tooth Position, and Size of Supporting Area. Robert F. Taylor, University of Washington.

CLEFT LIP AND PALATE

A Cephalometric Study of the Growth and Development in Cleft Lip and Palate Individuals From Birth to Four Years. Raleigh T. Williams, Northwestern University.

An Electromyographical Analysis of the Temporal and Masseter Muscles in Mandibular Overclosure Associated With the Cleft Palate Patient. Thomas J. Zwemer, Northwestern University.

CLASS II MALOCCLUSION AND ORTHODONTIC TREATMENT RESULTS

Dental Changes Accompanying Treatment of Class II Malocclusions by Extraoral Means. Robert Warren Baker, University of Illinois.

A Study of the Facial Skeletal Changes of Class II, Division 1 Malocclusion (Angle) by Orthodontic Treatment and Five Years After Active Treatment. Edwin Hagihara, Northwestern University.

A Cephalometric Radiographic Study of the Condylar and Incisal Guidance Presenting in Patients After Orthodontic Treatment and Retention. Paul E. Klein, Northwestern University.

A Cinefluorographic Evaluation of the Results of Orthodontic Treatment of Class II, Division 1 Malocclusions Which Previously Exhibited Posterior Translation of the Mandible and a Study of the Spatial Relationship of the Hyoid Bone. John V. Drake, University of Washington.

TECHNICAL AIDS IN RESEARCH

Registration of Orthodontic Diagnostic Records for Statistical Evaluation. Saul M. Bien.

RESEARCH REPORTS READ BY TITLE ONLY

(Listed alphabetically by author)

An Appraisal of Different Methods Used in Determining the Rest Position of the Mandible and the Resulting Free-Way Space by Cephalometric Roentgenograms. Roland M. Anderson, University of Washington.

A Cephalometric Evaluation of the Skeletal and Dental Pattern of 7- to 9-Year-Old Children With Excellent Occlusion. Frank P. Baird, University of Washington.

A Serial Cephalometric Study of Children With Excellent Occlusion Using Angular and Linear Measurements. John Q. Barnes, University of Washington.

A Study of the Incidence of Malocclusion and Facial Characteristics in Seattle High School Students Aged 15 to 20 Years. Samuel R. Blake, University of Washington.

A Serial Cephalometric Study of the Rest Position of the Mandible in Patients With Excellent Occlusions. Eugene F. Butori, University of Washington.

The Integration of Facial Skeletal Variants: A Serial Cephalometric Roentgenographic Analysis of Craniofacial Form and Growth. S. Eugene Coben, University of Iliinois.

Standardized Radiography Applied to Patients With Abnormal Growth and Development Patterns. Melvin I. Cohen, Harvard University.

A Study of Dentofacial Morphology and Temporalis Muscle Activity in Normal 7-Year-Old Children, Employing Cephalometric Radiography and Electromyography. Edward B. Cook and George W. Street, University of Toronto. A Serial Cephalometric Study of the Rest Position of the Mandible in Edentulous Individuals. J. A. R. Coulombe, Jr., University of Washington.

A Radiographic Study of the Facial Structures of the Central Australian Aborigine. Arthur H. Craven, University of Illinois.

A Serial Cephalometric Study of Facial Patterns in Children Having Excellent Occlusion and Class II Division 1 Malocclusion Using Angular Measurements. John D. Desposato, University of Washington.

An Analysis of Dental Casts of Patients Made Before and After Orthodontic Treatment, Aldo A. Dona, University of Washington.

A Cephalometric Study of Relationships of the Maxillary and Mandibular Central Incisors of Children Having Excellent Occlusion and Class II, Divisoin 1 Malocclusion. Richard O. Failor, University of Washington.

A Dentofacial Study of Seattle High School Students Aged 15 to 20 Years. Kenneth E. Gibbs, University of Washington.

A Comparative Electromyographic and Cephalometric Analysis of Distocclusion at Two Age Levels in Children. Rowland D. Haryett, University of Toronto.

An Experimental Study of the Changes in the Mandibular Fossa of the Rat Following Unilateral Condylectomy. Arthur M. Hayes, Columbia University.

A Correlative Study of Palato-Facial Growth Using the Cephalometric and Roentgenographic Cephalometric Technics. Alvaro C. Henriques, University of Pennsylvania.

The Mesio-Distal Width of the Deciduous and the Permanent Teeth of the Same Children Together With Correlations Between and Among Them. Bruce W. Higley, University of Iowa.

Serial Study of Dental Eruption During Later Childhood. Joseph W. Janda, University of Minnesota.

Oro-Myometric Studies Related to Various Types of Occlusion, Herbert I. Margolis, Arthur L. Seiler, and Prem Prakash, Tufts University.

A Cephalometric Evaluation and Comparison of Two Methods of Treatment of Class II Malocclusion in the Mixed Dentition. William C. McGovern, University of Washington.

A Cross-Sectional Study of Vertical Facial Dimensions of Children With Excellent Occlusions. Raymond W. McNair, University of Washington.

Reproducibility of Radiographic Recordings of Rest Position of the Mandible. John H. McNutt, University of Minnesota.

A Cephalometric Evaluation of Class II Malocclusions in the Mixed Dentition Treated by Occipital Anchorage. Archie E. Peterson, University of Washington.

A Cephalometric Study of Excellent Occlusion and Class I Malocclusion of Children and Adults. Benedict J. Petraitis, University of Washington.

Apical Root Resorption Under Orthodontic Therapy. John R. Phillips, University of Washington.

A Study of Angular Relationships of the Mandibular Incisors. Kenneth M. Roberts, University of Washington.

A Study of Intelligence Quotient and Manual Dexterity as Related to the Incidence of Sucking Habits in Children. A. W. Shanks, University of Toronto.

Width of the Nasopharynx and Related Anatomical Structures in Normal and Unoperated Cleft Palate Children. Jacob D. Subtelny, University of Illinois.

Extra-Alveolar Cephalometric Appraisal During Treatment: A New Approach. Thomas J. Watson, Washington University, St. Louis.

A Cephalometric Study of Size Relationships of the Normal Male Soft Palate. Robert H. Willis, University of Washington.

A Lateral Cephalometric Study of the Skeletal Pattern in Cleft Palate Patients From 6 to 13 Years of Age. Malcolm Yasny, University of Toronto.

Early Tissue Changes Following Tooth Movement in the Laboratory Rat at Varying Periods of Time After the Application of Stress. Peter K. J. Yen and Julian M. Rothblatt, Harvard University.

American Association of Orthodontists 1955 Annual Meeting

Another view of the Fairmont Hotel in San Francisco, where the American Association of Orthodontists will hold its 51st annual meeting May 8 through 12, 1955.

1955 Prize Essay Contest, American Association of Orthodontists

Eligibility.—Any member of the American Association of Orthodontists and any person affiliated with a recognized institution in the field of dentistry as a teacher, researcher, undergraduate, or graduate student shall be eligible to enter the competition.

Character of Essay.—Each essay submitted must represent an original investigation and contain some new significant material of value to the art of science of orthodontics.

Prize.—A cash prize of $500.00 is offered for the essay judged to be the winner. The committee, however, reserves the right to omit the award if, in its judgment, none of the entries is considered to be worthy. Honorable mention will be awarded to those authors taking second and third places. The first three papers will become the property of the American Association of Orthodontists and will be published. All other essays will be returned.

Specifications.—All essays must be in English, typewritten on 8½ by 11 inch white paper, double spaced with at least 1 inch margins. Each sheet must be numbered and bound or assembled with paper fasteners in a "brief cover" so that they may be handled easily. Three complete copies of each essay, including all illustrations, tables, and bibliography must be submitted. The name and address of the author must not appear in the essay.

For purpose of identification, the author's name, together with a brief biographical sketch which sets forth his or her dental and/or orthodontic training, present activity, and status (practitioner, teacher, student, research worker, etc.) should be typed on a seperate sheet of paper and enclosed in a sealed envelope. The envelope should carry the title of the essay.

Presentation.—The author of the winning essay will be invited to present it at the meeting of the American Association of Orthodontists to be held at the Fairmont Hotel, San Francisco, California, the week of May 9, 1955.

Judges.—The entries will be judged by the Research Committee of the American Association of Orthodontists.

Final Submission Date.—No essay will be considered for this competition unless received in triplicate at the following address on or before Feb. 15, 1955: Dr. Alton W. Moore, Medical Dental Building, Seattle, Washington.

J. A. Salzmann, Chairman, Research Committee
American Association of Orthodontists
654 Madison Ave.
New York 21, N. Y.

American Association of Orthodontists, 1955 Research Section Meeting

Continuing the policy of recent years, the program will consist of a series of ten-minute research reports which may be presented orally or read by title only. All persons engaged in research are urged to participate in this program which will be held Wednesday afternoon, May 11, 1955, in the Fairmont Hotel, San Francisco, California.

Each participant is asked to prepare a 250-word abstract for publication in the AMERICAN JOURNAL OF ORTHODONTICS. Abstract for publication and the ten-minute oral presentation at the meeting should be carefully prepared to present an adequate description of the import of your investigation.

Forms for use in submitting the title and 250-word abstract of your research will be sent to each dental school orthodontic department and to any individual requesting one. Please send your title and abstract as early as possible, but not later than March 10, 1955, to Dr. Thomas D. Speidel, University of Minnesota, School of Dentistry, Minneapolis 14, Minnesota.

J. A. Salzmann, Chairman
Research Committee
American Association of Orthodontists
654 Madison Ave.
New York 21, N. Y.

American Board of Orthodontics

The next meeting of The American Board of Orthodontics will be held at the Fairmont Hotel in San Francisco, California, May 3 through May 7, 1955. Orthodontists who desire to be certified by the Board may obtain application blanks from the secretary, Dr. C. Edward Martinek, 661 Fisher Bldg., Detroit 2, Michigan.

Applications for acceptance at the San Francisco meeting, leading to stipulation of examination requirement for the following year, must be filed before March 1, 1955. To be eligible, an applicant must have been an active member of the American Association of Orthodontists for at least three years.

Central Section of the American Association of Orthodontists

The seventeenth annual session of the Central Section of the American Association of Orthodontists met Oct. 4 and 5, 1954, at the Park Plaza Hotel in St., Louis, Missouri. The scientific program presented follows.

MONDAY, OCT. 4, 1954

Morning Session

President's Address.
Earl E. Shepard, St. Louis, Missouri.

The Significance of Early Loss of Primary Teeth in the Etiology of Malocclusion—Anders Lundstrom, Royal School of Dentistry, Stockholm, Sweden.

St. Louis and Early Orthodontics.
H. Carlyle Pollock, Editor, *American Journal of Orthodontics,* St. Louis, Missouri.

Address: Religions Other Than My Own.
Elias S. Khalifah, St. Louis, Missouri.

Afternoon Session

Some Considerations in Orthodontic Treatment.
Paul V. Ponitz, Battle Creek, Michigan.

Assisting Unerupted Teeth.
James C. Toothacher, South Bend, Indiana.

Oral Pathology in Children.
Chas. A. Waldron, St. Louis, Missouri.

TUESDAY, OCT. 5, 1954

Morning Session

Labial and Lingual Appliances: Choice and Construction.
Ernest N. Bach, Toledo, Ohio.

Analysis of Jaw Relations in Class II Malocclusions.
Lawrence W. McIver, Minneapolis, Minnesota.

Panel Discussions of Problems Presented by the Essayists.

Participants:

Dr. Anders Lundstrom, Stockholm, Sweden.
Dr. Paul V. Ponitz, Battle Creek, Michigan.
Dr. James C. Toothacher, Sout Bend, Indiana.
Dr. Chas. A. Waldron, St. Louis, Missouri.
Dr. Ernest N. Bach, Toledo, Ohio.
Dr. Lawrence W. McIver, Minneapolis, Minnesota.

Presiding: Dr. Earl E. Shepard, President.

Address: Some Problems Facing the Dental Profession.
Harold Hillenbrand, Secretary of the American Dental Association, Chicago, Illinois.

Afternoon Session

(Director, William Brandhorst)

Clinics and Case Reports.

The afternoon was devoted to clinics and case reports. As an innovation, table clinics, as such, were eliminated and the clinicians were asked to prepare their material so as to present it one time to the entire audience, by means of charts, lantern slides, etc. Case reports were similarly presented.

Second Bicuspid Extraction in a Deceptively Simple Class I Malocclusion. Burl F. Dewel, Evanston, Illinois.

Fools Rush in Where Saints Fear to Tread. Howard Yost, Grand Island, Nebraska.

Case Report Demonstrating Role of Upper Second Molar Extraction in Orthodontic Treatment. Thomas M. Graber, Chicago, Illinois.

Case Report of a Class II, Division 2, Demonstrating Lip Tension Habit and Its Correction. David J. Thompson, Elmhurst, Illinois.

Functional Problems in Orthodontic Treatment. Robert W. Donovan, Chicago, Illinois.

A Simplified Means of Standardizing Your Photographic Technique. Fredrick B. Lehman, Cedar Rapids, Iowa.

A Change in Case Analysis During Treatment. George L. Englert, Danville, Illinois.

Middle Atlantic Society of Orthodontists

The third annual meeting of the Middle Atlantic Society of Orthodontists was held at the Chalfonte-Haddon Hall in Atlantic City on Oct. 3, 4, and 5, 1954. Registration figures were slightly better than an even 100.

The meeting opened on Sunday with a reception and buffet supper in honor of President and Mrs. Ray Sheridan.

On Monday, B. Holly Broadbent gave one of his very best illustrated talks on "The Application of Bolton Standard to Diagnosis and Treatment." The usual lively discussion period which has always been a Middle Atlantic characteristic followed.

A luncheon honoring two of the Society's elder members, Andrew F. Jackson and Earl W. Swinehart, proved to be an enjoyable occasion. Paul Reid and George Anderson, on behalf of Dr. Jackson and Dr. Swinehart, sketched a résumé of their lives and work for the admiring audience of members and their ladies.

In the afternoon, S. J. Kloehn presented his now famous paper entitled "Guiding Growth and Eruption," which was also much appreciated and discussed.

On Tuesday the Society divided into four sections to attend four well-organized rotating clinics. Each member was entitled to visit two of the following clinics:

1. "Supplementing Paper" by S. J. Kloehn.
2. "A Method of Treatment and Retention" by John M. Jackson.
3. "How the Use of Coil Springs and Russell Lock With the Edgewise Technique Will Save a Lot of Your Valuable Time" by Clifford L. Whitman.
4. "Edgewise Arch Band Placement, Use of Attachments and Cementation" by Brainerd F. Swain.

The afternoon was devoted to a panel discussion of diagnosis and treatment. The moderator was George M. Anderson, and panel members were Drs. Broadbent, Kloehn, Jackson, Whitman, and Swain.

Walter M. Dunlap was the able chairman of the Program Committee.

Members, guests, and especially the ladies, enjoyed brief visits to the Board Walk in the salubrious October sunshine and a few hardy souls battled the surf in surprising 70 degree water temperature. It must be admitted that the lecture and clinic room temperature became a little high at times, particularly during discussion periods.

Officers elected for the ensuing year are:

President-Elect	Daniel Shehan
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Editor	Stephen C. Hopkins
Secretary-Treasurer	Paul Deems
Member of the Board of Censors	Raymond Sheridan
Director to the American Association of Orthodontists	Emil Rosenast, Sr.
Alternate Director	Gerald Devlin

The next meeting is scheduled for Oct. 23, 24, and 25, 1955, at the Shoreham Hotel in Washington, D. C.

Northeastern Society of Orthodontists

The Northeastern (formerly New York) Society of Orthodontists held its fall meeting Oct. 25 and 26, 1954, at the Hotel Statler in Buffalo, New York. The following program was enjoyed.

Case Report. Warren R. Mayne, Salem, Massachusetts.

Extraoral Appliances—Facts and Fallacies. T. M. Graber, Chicago, Illinois.

Human Head and Figures. Wilfred I. Duphiney, Providence, Rhode Island.

On the Relative Importance of Genetic and Nongenetic Factors to the Profile of the Facial Skeleton (based on twin investigation). Anders Lundstrom, Stockholm, Sweden.

Guest Speaker—Mr. Leston Faneuf, General Manager, Bell Aircraft.

A Rationale for Closer Cooperation Between the Orthodontist and the Speech and Hearing Therapist.* Barnett Frank, Rochester, New York.

Problems and Limitations of Cephalometric Analysis. T. M. Graber, Chicago, Illinois.

Correction of Mandibular Prognathism by Bilateral Osteotomy. Bernard G. Wakefield, Buffalo, New York.

An Analysis of Changes in the Dentofacial Skeleton Following Orthodontic Treatment. Coenraad F. A. Moorrees, Boston, Massachusetts.

The Correlation Between Size of Teeth and Relative Arch Spacing. Anders Lundstrom, Stockholm, Sweden.

Diagnosis and Treatment—Occipital Anchorage. Walter Mosmann, Hackensack, New Jersey.

Analysis of Orthodontic Deformity Employing Lateral Cephalostatic Radiography. Harvey Jenkins, Toronto, Canada.

Guest Speaker—Dr. Frederick T. West, President of A. A. O., San Francisco, California. Your President Reports.

CLINICS:

1. The Rehabilitation of the Cleft Palate Child. J. Sutton Reagen Cleft Palate Foundation, Buffalo, New York.
2. Clinic Supplementing Paper by C. F. A. Moorrees. Peter Kai-jen Yen and Marie Louise Harin.
3. Clinic Supplementing Paper. Walter Mosmann.
4. Clinic Supplementing Paper. Barnett Frank.
5. Clinic Supplementing Paper. Harvey Jenkins.

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*This paper was prepared in partial fulfillment of the requirements for certification by the American Board of Orthodontics.

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Vernon Hunt Dies in California

Orthodontists were shocked early in September to learn of the death of Dr. Vernon Hunt of Eureka, California. Dr. Hunt was drowned while fishing in the Klamath River, along with two of his friends, Dr. Frank Smith and Mr. Ritchie Wood.

Dr. Hunt, it will be remembered, contributed much to the program of the American Association of Orthodontists in Chicago last May.

A suitable obituary will be printed later.

Orthodontists Honored

On July 10, in the solemn atmosphere of one of Britain's oldest and most renowned universities, and with traditional dignity, the appropriately gowned Royal Faculty of Physicians and Surgeons of Glasgow, Scotland, granted a D.D.O. (diploma in Dental Orthopedics) to ten distinguished orthodontists: Dr. Holly Broadbent of Western Reserve University, Director of Orthodontic Research under the Bolton Fund, Cleveland, Ohio; Sheldon Friel, Dublin, Ireland; Dr. Andrew F. Jackson, orthodontic teacher and lecturer of Philadelphia, Pennsylvania; Dr. Irvin Johnson, Bristol University, President of the British Society for the Study of Orthodontics; Dr. Charles Kimball, Edinburgh University; Dr. Russell March, Kings College, London; Dr. Charles Nord, Amsterdam, Holland; Dr. Ernest Rix, General Hospital, London, President of the European Orthodontic Society; Professor R. Selmer Olsen, Dean of the Oslo Dental School, Norway; and Dr. Harold Watkins, formerly of Liverpool and of Manchester Dental Schools.

After the citation for each of the orthodontists had been read and the roll signed, the president presented each of the new diplomates with scrolls.

Dr. Charles Nord replied in behalf of the ten recipients. He congratulated the faculty on its ancient origin in 1599 prior to the union of the House of Scotland and England. He hinted that the superiority of Scottish law over English law might be partly due to the fact that so many Scottish lawyers in the sixteenth century received their legal training in the Dutch University of Leyden. Dr. Nord also stated that, in spite of its ancient charter, the Royal Faculty was the first licensing body to recognize orthodontics as a specialty and to grant a diploma which recognized that fact.

In reply, the president of the Royal Faculty expressed the hope that dental and medical specialists throughout the world will continue to cooperate to their mutual benefit, as they now do in Glasgow. He remarked that of the ten new diplomates, only one, Dr. Andrew Jackson of Philadelphia, could claim to be of Scottish blood, so the Faculty could not be accused of parochialism or prejudice in the selection of the ten orthodontists who had been so signally honored.

Subsequent to the ceremony, the new diplomates and their wives and friends were entertained by the Council of the Royal Faculty. Many Americans and other visitors expressed a desire to see the portrait of David Livingstone, the missionary, who was an honorary fellow of the Royal Faculty.

Some were surprised to learn that Lord Lister introduced antiseptic methods to surgery in Glasgow, and that his assistant, afterwards Sir William McEwen, introduced the asceptic surgery. John Hunter, the father of dentistry, received his medical training from his elder brother. The birthplace of the Hunter Brothers outside of Glasgow recently has been turned into a national museum, largely through the efforts of the Royal Faculty of Surgeons and Physicians of Glasgow.

As a compliment to the Glasgow Dental School, the new diplomates insisted on visiting the Orthodontic Department.

American Dental Association

St. Louis, Oct. 5.—A record number of dentists are seeking advanced training beyond graduation from dental school, the secretary of the American Dental Association reported recently.

Dr. Harold Hillenbrand, of Chicago, speaking at a luncheon at the seventeenth annual meeting of the Central Section of the American Association of Orthodontists at the Park Plaza Hotel in St. Louis, Missouri, said that more than 5,000 members of the dental profession this year sought advanced degrees or specialized knowledge or went back to school to keep abreast of the latest advances in dental techniques.

At the same time, the dental executive reported that more young people are seeking to enter the profession than ever before in the nation's history.

He said nearly 13,000 students are working toward dental degrees in the nation's forty-three dental schools, an increase of almost 50 per cent over 1947. He also reported that there were some 7,500 applicants for the 3,300 vacancies in this fall's freshmen classes.

St. Louis University is Host to Dentists From Mexico

The Orthodontics Department at St. Louis University played host to seven dentists from National University of Mexico, Sept. 13 to 20, 1954.

The visitors were Drs. Adolfo Unda, Francisco Navarro, Manuel Castro Cue, Francisco Calderon Caso, Carmel Carbajal, Rosa Olvera, and Hans H. Kentler.

A reception was held for the students at the conclusion of the stay at the University.

Notes of Interest

Frederick R. Aldrich, D.M.D., announces the association of John E. Aldrich, D.D.S., Medical Arts Bldg., 327 East State St., Columbus, Ohio, practice limited to orthodontics.

Dr. Sam Blausten wishes to announce the opening of his office at 253 Main St., Farmingdale, Long Island, New York, for the exclusive practice of orthodontics.

Henry J. Bohrman, B.S., M.S., D.D.S., announces the removal of his office to 228 South State St., Marion, Ohio, practice limited to orthodontics.

Samuel D. Gore, D.D.S., announces the association of Samuel D. Gore, Jr., D.D.S., M.S., for the practice of orthodontics, and the removal of their offices to 1037 Maison Blanche Bldg., New Orleans 16, Louisiana.

Arnold E. Leeds, D.D.S., announces the removal of his office from 76 Washington Ave., Garden City, New York, to the Hempstead Medical Center, 230 Hilton Ave., Hempstead, New York, practice limited to orthodontics.

James C. Marsters, D.D.S., announces the opening of his office at 761 East Union St., Pasadena, California, orthodontics exclusively.

Franklyn C. Nelson, D.D.S., M.D.S., announces the opening of his office at 313 Progress Bulletin Bldg., Pomona, California, practice limited to orthodontics exclusively.

John D. Owens, D.D.S., announces the association of Frank E. Shepard, D.D.S., for the exclusive practice of orthodontics, 202 J & M Bldg., 211 East Harrison, Harlingen, Texas.

Dr. A. Raymond Tannenbaum announces his return from military service, where he was organizer and chief of the Orthodontic Department at Parks Air Force Base, California. Private practice is now resumed at 1001 North Elm St., Greensboro, North Carolina.

Thomas J. Watson, D.D.S., Brentwood Medical Center, 1695 Brentwood Blvd., St. Louis 17, Missouri, announces the opening of his office, practice limited to orthodontics.

Dr. M. Jay Zweibach announces his association with Dr. Simon W. Sheffield, 2021 Grand Concourse (Royal Hospital Bldg.), New York 53, New York, practice limited to orthodontics.

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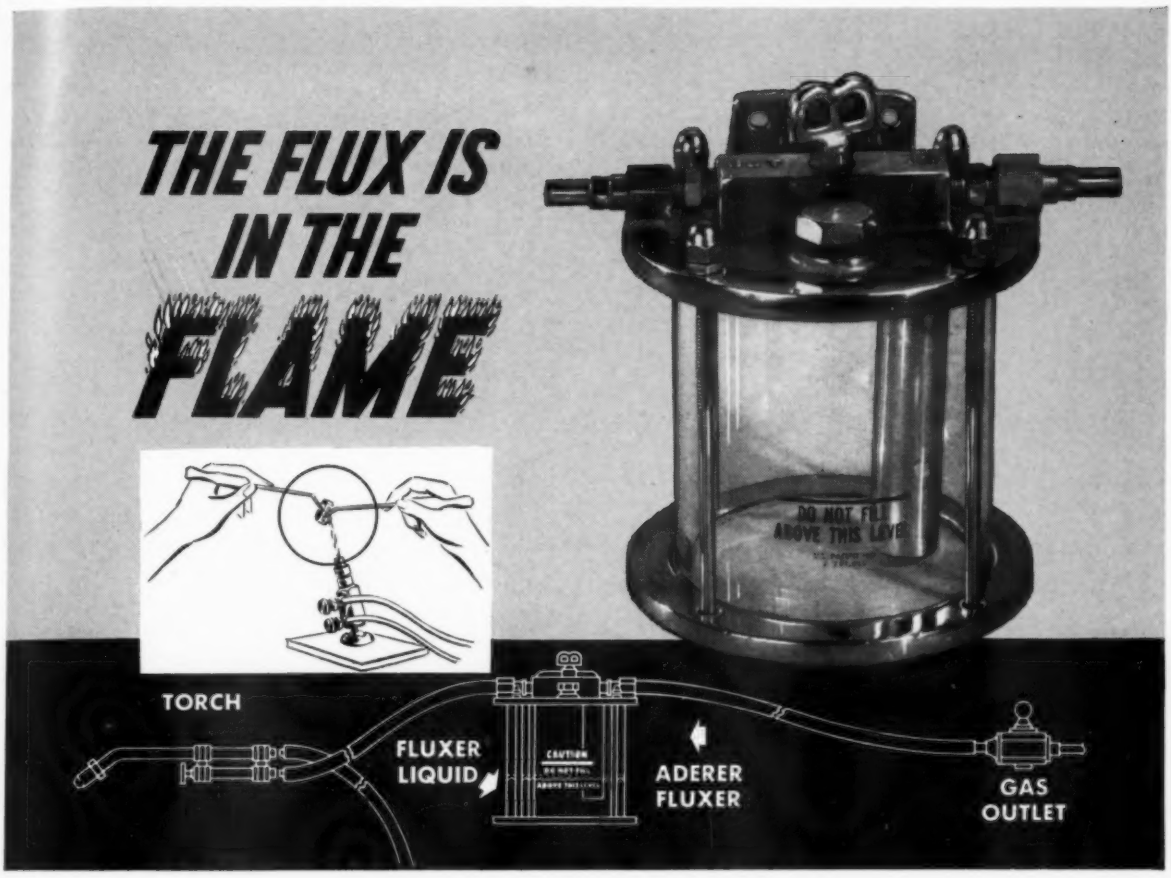

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